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ABSTRACT

This agenda lists activities scheduled for the second IBM (International Business Machines) Academic Information Systems University AEP (Advanced Education Projects) Conference, which was designed to afford the universities participating in the IBM-sponsored AEPs an opportunity to demonstrate their AEP experiments in educational computing. In addition to a complete listing of events scheduled for each day of the conference, agenda contents include biographies of the guest speakers, Robert M. Williams and Raymond L. Orbach; presentation abstracts arranged according to the session at which they were presented; the conference format; and indexes by university or organization, presenter/chairperson, and presentation title. A listing of program committee members and a letter from the conference host are also provided. (KM)

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IBM

AGENDA
Academic Information Systems University AEP Conference

San Diego, California April 5-8, 1986

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TOOLS FOR LEARNING

1986

UNIVERSITY AEP CONFERENCE

April 5-8
San Diego, California

PREFACE

The second IBM sponsored University AEP Conference will be held at the Sheraton Harbor Island East Hotel in San Diego, California, April 5 through April 8, 1986. This conference will afford the universities participating in IBM's Advanced Education Projects (AEP) an opportunity to demonstrate a number of their AEP experiments in educational computing. The conference theme will be "Tools for Learning".

This agenda book is provided to attendees so that they may each select their personal agenda from the variety of parallel sessions offered.

The abstracts included in this document are presented essentially as submitted by the authors. Editorial changes were limited to typographical error correction.

PROGRAM COMMITTEE

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Princeton University

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Computing Resource Center
University of Pennsylvania

Dr. Ronald F. E. Weissman
Director,
Instructional Computing Programs
& Director, Project FULCRUM
University of Maryland

International Business Machines Corporation

472 Wheelers Farms Road
Milford, Ct. 06460
203/783-7000

February 26, 1986

TO: 1986 University AEP Conference Attendees

I'm delighted to be your host at this second University AEP Conference. Since our conference in Alexandria last June, I've visited many AEP campuses, and my excitement over the innovative uses of computing technology on these campuses continues to grow.

This year we welcome to the Conference representatives from colleges and universities not directly involved in Advanced Education Projects. We hope that this Conference will initiate a process by which the insights gained at the AEP schools will be shared broadly across the higher education community.

I'm very much looking forward to spending these four days with you in San Diego. I hope you'll find them stimulating, valuable and enjoyable.

Sincerely,

Al

A. R. DeFlorio

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General Manager
IBM ACIS

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Information Systems & Communications Group
General Manager
Engineering Systems Products 23

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Provost
College of Letters and Science
University of California, Los Angeles 25

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AGENDA
Parallel Sessions
UNIVERSITY AEP CONFERENCE

San Diego, California, April 5-8, 1986

I. SESSION A - SATURDAY, APRIL 5, 1986
10:00 - 12:00 P.M.

IBM TECHNICAL PRESENTATIONS

A-1 RT PC HARDWARE AND AIX SYSTEM SOFTWARE
Presented by: *TBA*

A-2 DEVELOPING INTERACTIVE GRAPHICS APPLICATIONS WITH graPHIGS
Presented by: *William G. Tuel, Jr.*
IBM Palo Alto Scientific Center

A-3 AUTHORING SYSTEMS
Presented by: *TBA*

A-4 ACADEMIC INFORMATION SYSTEMS 4.2 AND ANDREW
Presented by: *TBA*

A-5 IBM WORKSTATION NETWORKING OPTIONS AND FACILITIES
Presented by: *TBA*

II. SESSION B - 1 SATURDAY, APRIL 5, 1986
1:00 - 2:30 P.M.

EXPERT TUTORIALS AND ROUND TABLES

B-1 PROPOSED AEP SOFTWARE DISTRIBUTION
Chairperson: *Jacqueline Brown*
Princeton
Presented by: *Tad B. Pinkerton*
University of Wisconsin

B-2 TUTORIAL: ROUND TABLE IN SIMULATION METHODS
Chairperson: *Chad K. McDaniel*
University of Maryland
Presented by: *J. D. Welsh*
Princeton University

AGENDA (continued)

B-3 PANEL ON THE IMPLEMENTATION OF GRAPHICS APPLICATIONS

Chairperson:	*J. Poage* Princeton University
Panelists:	*Kirk D. Alexander* Princeton University *Reggie Caudill* University of Alabama *Jim Morris* Carnegie-Mellon University

B-4 TUTORIAL: C-MU TUTOR

Presented by:	*Bruce Sherwood* Carnegie-Mellon University

B-5 SYMPOSIUM NETWORKING WORKSTATIONS TO MAINFRAMES

Chairperson:	*Cliff Gillman* University of Wisconsin
Panelists:	*Richard Cogger* Cornell University *Susan Greenberg* University of Illinois *Phil Long* Yale University *Glenn Ricart* University of Maryland

---

III. SESSION B - 2 SATURDAY, APRIL 5, 1986 2:45 - 4:15 P.M.

EXPERT TUTORIALS AND ROUND TABLES

B-1 ROUND TABLE: BEYOND AEP

Chairperson:	*Norman N. Mintz* Columbia University
Panelists:	*Albert P. Barber* University of California, Los Angeles *Robert Barker* Cornell University

AGENDA (continued)

B-2 ROUND TABLE: DISCUSSION ON FOREIGN LANGUAGE PROCESSING

Chairperson: *C. M. Sperberg-Mcqueen*
Princeton University
Panelists: *Nina Garrett*
University of Illinois
Janet Murray
Massachusetts Institute of Technology
Slava Paperno
Cornell University

B-3 TUTORIAL: IMAGE DISPLAY WITH THE IBM PROFESSIONAL GRAPHICS CONTROLLER

Chairperson: *Cecilia M. Cowles*
Cornell University
Presented by: *TBA*

B-4 TUTORIAL: C-MU TUTOR (continued)

Presented by: *Bruce Sherwood*
Carnegie-Mellion University

B-5 LOCAL AREA NETWORKS

Chairperson: *Cliff Gillman*
University of Wisconsin

DESIGNING AN EFFECTIVE LOCAL AREA NETWORK FOR INSTRUCTION

Presented by: *Randy Siler*
University of Washington

DESIGN SUPPORT SYSTEMS FOR ARCHITECTS AND PLANNERS

Presented by: *Joseph Ferreira, Jr.*
Massachusetts Institute of Technology

DESIGNING LOCAL AREA NETWORKS FOR THE ACADEMIC ENVIRONMENT

Presented by: *Stuart Bogom*
University of Pennsylvania

AGENDA (continued)

B-5 LOCAL AREA NETWORKS (continued)

NETWORKING TO SUPPORT EDUCATIONAL OBJECTIVES

Presented by: *Michael K. Stenstrum*
University of California, Los Angeles

IV. SESSION B - 3 SATURDAY, APRIL 5, 1986
4:30 - 6:00 P.M.

EXPERT TUTORIALS AND ROUND TABLES

B-1 SOCIAL AND MANAGERIAL ISSUES

TUTORIAL: ON MANAGEMENT AND SOCIAL ISSUES

Chairperson: *Gerald J. Porter*
University of Pennsylvania
Panelists: *Patricia B. Helm*
University of Pennsylvania
M. S. Mahoney
Princeton University
Michael H. Pleck
University of Illinois

B-2 WINDOWS & GEM

Chairperson: *Howard Rumsey, Jr.*
California Institute of Technology
Panelists: *Paul Davis*
Microsoft Corporation
Don Anderson
University of California, San Diego

B-3 TUTORIAL PROGRAMMING BEYOND TURBO - PROFESSIONAL GRAPHICS CONTROLLER

Chairperson: *Donald R. Riley*
University of Minnesota
Presented by: *Lee B. Anderson*
University of Minnesota

AGENDA (continued)

B-4 INTERACTIVE VIDEODISC TECHNOLOGY

TUTORIAL: DESIGN AND USES OF INTERACTIVE VIDEODISC TECHNOLOGY

Chairperson:	*Cecilia M. Cowles* Cornell University
Panelists:	*Geri K. Gay* Cornell University *D. Lieberman* Stanford University *Stan Smith* University of Illinois

B-5 ELECTRONIC MUSIC SYNTHESIS

TUTORIAL: REMOTE ELECTRONIC MUSIC SYNTHESIS WORKSTATIONS

Chairperson:	*Wayne A. Danielson* University of Texas
Presented by:	*Russell Pinkston* University of Texas

V. PLENARY SESSION - SUNDAY, APRIL 6, 1986 1:00 - 2:00 P.M.

Agenda	*Al DeFlorio* (Master of Ceremonies) Acting Director, Special Studies & Academic Projects IBM ACIS
Welcome	*John C. Daily* General Manager IBM ACIS
Keynote Address	*Raymond L. Orbach* Provost College of Letters and Science University of California, Los Angeles

AGENDA (continued)

VI. SESSION C - SUNDAY, APRIL 6, 1986 2:00 - 3:00 P.M.

C-1 TUTORIAL: SOFTWARE DESIGN PRINCIPLES FOR INSTRUCTIONAL APPLICATIONS
Chairperson: *Donald R. Riley*
University of Minnesota
Presented by: *Stanley R. Trollip*
University of Minnesota

C-2 HISTORY
Chairperson: *Ronald F.E. Weissman*
University of Maryland

DEMOGRAPHIC MICROSIMULATION
Presented by: *Chad K. McDaniel*
University of Maryland

THE GREAT AMERICAN HISTORY MACHINE
Presented by: *David Miller*
Carnegie-Mellon University

RECONSTRUCTING A HISTORICAL COMMUNITY
Presented by: *Myron P. Gutmann*
University of Texas, Austin

C-3 BIOLOGICAL SIMULATION I
Chairperson: *Patricia L. Devaney*
Stanford University

INTERACTIVE COURSEWARE SIMULATION FOR FRUIT FARM MANAGERS
Presented by: *Emily Hoover*
University of Minnesota

SIMULATING PREHISTORIC HUNTING PRACTICES
Presented by: *John Rick*
Stanford University

AGENDA (continued)

C-4 GEOLOGY AND EARTH SCIENCE

Chairperson: *Jacqueline D. Brown*
Princeton University

REPRESENTATION OF DENSITY DISTRIBUTION ON A SPHERE WITH COLOR GRAPHICS ON AN IBM PC XT
Presented by: *Lars Stixrude*
University of California, Berkeley

CRYSTALLOGRAPHY IN GEOLOGY
Presented by: *Ed Mulligan*
University of Washington

INTERACTIVE GRAPHICS FOR DISPLAY & ANALYSIS OF EARTHQUAKE SEISMOGRAMS
Presented by: *Anthony Lomax*
University of California, Berkeley

SATELLITE IMAGE PROCESSING AND DISPLAY FOR UNDERGRADUATE USE
Presented by: *Ronald J. P. Lyon*
Stanford University

C-5 ECONOMICS

Chairperson: *John Goldin*
Yale University

PC's IN THE ECONOMIC CURRICULUM AT YALE UNIVERSITY
Presented by: *Matthew D. Shapiro*
Yale University

COMPUTER-ASSISTED LECTURES IN ECONOMIC THEORY
Presented by: *Steven M. Goldman*
University of California, Berkeley

THE INS AND OUTS OF MACROECONOMIC FORECASTING: A TUTORIAL FOR STUDENTS
Presented by: *John Haltiwanger*
University of California, Los Angeles

AGENDA (continued)

C-5 ECONOMICS (continued)

NESTED FIXED POINT ALGORITHM
Presented by: *John Rust*
University of Minnesota

VII. SESSION D - MONDAY, APRIL 7, 1986
8:30 - 10:30 A.M.

D-1 PANEL: SOFTWARE DEVELOPMENT STRATEGIES

Chairperson: *Jean Dexheimer*
Carnegie-Mellon University
Panelists: *A. Bork*
University of California, Irvine
M. Carter
Stanford University
F. Hofstetter
University of Delaware
Bruce Sherwood
Carnegie-Mellon University

D-2 MEDICAL EXPERT SYSTEMS

Chairperson: *William Schwartz*
University of Pennsylvania

CAMPS: (Computer Assisted Medical Problem Solving) THE DEVELOPMENT AND USE OF A SYSTEM TO TEACH AND EVALUATE MEDICAL PROBLEM SOLVING
Presented by: *William Schwartz*
University of Pennsylvania

MEDCAT/CATS: TWO ARTIFICIAL INTELLIGENCE APPLICATIONS IN MEDICAL EVALUATION
Presented by: *Martin Gardy*
Cornell University

MICROCOMPUTER BASED MEDICAL EXPERT SYSTEMS
Presented by: *Stan Tuhrim*
University of Maryland

AGENDA (continued)

D-2 MEDICAL EXPERT SYSTEMS (continued)

DEVELOPMENT OF A COMPUTERIZED PHARMACY PRACTICE SIMULATION
Presented by: *Michael Pitterle*
University of Wisconsin

USE OF EXPERT SYSTEMS TO TEACH VETERINARY DIAGNOSTIC DECISION MAKING
Presented by: *Ronald D. Smith*
University of Illinois

D-3 TEXT DATA-BASES

Chairperson: *John R. Abercrombie*
University of Pennsylvania

THE GENIZA PROJECT
Presented by: *Mark Cohen*
Princeton University

A SUMERIAN DICTIONARY OF THE THIRD MILLENNIUM B.C.
Presented by: *David I. Owen*
Cornell University

THE FACILITY FOR THE COMPUTER ANALYSIS OF TEXTS
Presented by: *John Abercrombie*
University of Pennsylvania

SPINNING A WEB OF SCHOLARLY WORK: A SURVEY OF ENGLISH LITERATURE AS ENHANCED BY THE INTERMEDIA SYSTEM
Presented by: *George Landow*
Brown University

ISOCRATES: ALL OF GREEK LITERATURE ON A CD ROM
Presented by: *Paul Kahn*
Brown University

AGENDA (continued)

D-4 CHEMICAL ENGINEERING AND CHEMISTRY

Chairperson: *George Galloway*
Cornell University

IRIS: A TOOL FOR LEARNING
Presented by: *Bruce H. Robinson*
University of Washington

INTERACTIVE GRAPHICS IN CAD/CAI IN CHEMICAL ENGINEERING
Presented by: *Daniel R. Lewin*
California Institute of Technology

COMPUTER GRAPHICS FLOW VISUALIZATION FOR UNDERGRADUATE INSTRUCTION
Presented by: *William L. Olbricht*
Cornell University

DEVELOPMENT OF AN EXPERT SYSTEM FOR COMPUTER-AIDED INSTRUCTION IN PROCESS CONTROL
Presented by: *Manfred Morari*
California Institute of Technology

CHEMCIL: AN INTELLIGENT CHEMICAL STENCIL FOR CALCULATION OF 3D MOLECULAR COORDINATES
Presented by: *Michael B. Bolger*
University of Southern California

D-5 GRAPHICS HARDWARE AND SYSTEMS

Chairperson: *Gregory Zick*
University of Washington

A PRACTICAL AUTHORING SYSTEM COMBINING COMPUTER-BASED INSTRUCTION WITH A VIDEO DIGITIZER
Presented by: *Mark A. Guenin*
University of Pennsylvania

AGENDA (continued)

D-5 GRAPHICS HARDWARE AND SYSTEMS (continued)

AN INSTRUCTIONAL FACILITY FOR COMPUTER VISION AND IMAGE PROCESSING
Presented by: *Anthony P. Reeves*
Cornell University

IMAGE LABORATORY
Presented by: *Ferd Maisel*
University of Maryland

GENERALIZED VIDEOTEX LABORATORY
Presented by: *John Bowes*
University of Washington

SCRIPTWRITER: INTEGRATED SOFTWARE DEVELOPMENT ENVIRONMENT FOR CAI
Presented by: *Ellis Horowitz*
University of Southern California

VIII. SESSION E - MONDAY, APRIL 7, 1986
11:00 - 12:00 P.M.

E-1 ROUND TABLE: ASSESING EDUCATIONAL OUTCOMES OF MICROCOMPUTER PROJECTS IN INSTRUCTION AND RESEARCH

Chairperson: *Wayne A. Danielson*
University of Texas, Austin
Panelists: *Hellmut Golde*
University of Washington
Richard F. Wilson
University of Illinois

E-2 BIOLOGICAL SIMULATION II

Chairperson: *Ronald F. E. Weissman*
University of Maryland

AGENDA (continued)

E-2 BIOLOGICAL SIMULATION II (continued)

COMPUTER ASSISTED INSTRUCTION IN NEUROANATOMY
Presented by: *Steven E. Brauth*
University of Maryland

PHYSIOLOGICAL SIMULATIONS IN STUDENT LABORATORIES
Presented by: *Robert R. Macey*
University of California, Berkeley

EVALUATION OF A BAYESIAN FORECASTING MICROCOMPUTER PROGRAM FOR THEOPHYLLINE THERAPY IN PREMATURE INFANTS
Presented by: *Paul J. Godley*
University of Texas, Austin

E-3 PHILOSOPHY AND LOGIC

Chairperson: *Peggy Seiden*
Carnegie-Mellon University

COMPUTER ASSISTED INSTRUCTION IN PHILOSOPHY
Presented by: *Steven Bend*
Carnegie-Mellon University

LOGIC: A WORKBOOK
Presented by: *Robert L. Martin*
University of California, Los Angeles

PHILOSOPHICAL SIMULATIONS AND EXPERIMENTS
Presented by: *Robert L. Causey*
University of Texas, Austin

E-4 ELECTRICAL ENGINEERING

Chairperson: *Gregory Zick*
University of Washington

AGENDA (continued)

E-4 ELECTRICAL ENGINEERING (continued)

COMPUTER-AIDED DESIGN OF MICROWAVE INTEGRATED CIRCUITS
Presented by: *David Rutledge*
California Institute of Technology

COMPUTER-AIDED SYSTEM ANALYSIS AND DESIGN
Presented by: *Bradley W. Dickinson*
Princeton University

A PC-BASED VLSI DESIGN SYSTEM FOR EDUCATION
Presented by: *Mani Soma*
University of Washington

E-5 PSYCHOLOGY

Chairperson: *John Goldin*
Yale University

LABORATORIES FOR INTRODUCTORY PSYCHOLOGY
Presented by: *David R. Williams*
University of Pennsylvania

COMPUTER BASED INSTRUCTIONAL MATERIALS IN COUNSELING PSYCHOLOGY
Presented by: *James L. Lee*
University of Wisconsin

MICROCOMPUTERS AND THE SPEED OF THOUGHT: A COGNITIVE TESTING STATION FOR MEASURING AND ALTERING RAPID COGNITIVE PROCESSES
Presented by: *Kevin F. Miller*
University of Texas, Austin

AGENDA (continued)

IX. SESSION F - MONDAY, APRIL 7, 1986 1:30 - 3:30 P.M.

F-1 TUTORIAL: PSYCHOLOGICAL PRINCIPLES UNDERLYING THE DESIGN OF COMPUTER-BASED INSTRUCTION

Chairperson: *Geri K. Gay*
Cornell University
Panelists: *Ruth Chabay*
Stanford University
Sharon Dugdale
University of Illinois
Bruce Sherwood
Carnegie-Mellon University

F-2 TUTORIAL: IS CONVERGENCE ON A WINDOW MANAGER/ ENVIRONMENT STANDARD POSSIBLE?

Presented by: *Andries Van Dam*
Brown University

F-3 QUANTITATIVE METHODS

Chairperson: *G. Galloway*
Cornell University

TOOLS FOR LEARNING DATA ANALYSIS
Presented by: *Eugene Kroch*
University of Pennsylvania

LINPRO: A SOFTWARE PACKAGE FOR AID IN TEACHING THE RUDIMENTS OF LINEAR PROGRAMMING
Presented by: *E. Andrew Boyd*
Massachusetts Institute of Technology

ENHANCING THE ANALYTIC COMPONENT OF QUANTITATIVE METHODS
Presented by: *Susan G. Hadden*
University of Texas, Austin

AGENDA (continued)

F-3 QUANTITATIVE METHODS (continued)

MICROCOMPUTER SYSTEM FOR VEHICLE ROUTING

Presented by: *Lawrence Bodin*
University of Maryland

SAMP-A PROGRAM TO COMPUTE SAMPLE SIZE

Presented by: *Peter A. Lachenbruch*
University of California, Los Angeles

F-4 CIVIL ENGINEERING AND AVIATION

Chairperson: *J. B. Neethling*
University of California, Los Angeles

TEACHING NUMERICAL MATHEMATICS USING INTERACTIVE COMPUTER GRAPHICS

Presented by: *George F. Pinder*
Princeton University

WHICH WAVE THEORY?

Presented by: *Rodney J. Sobey*
University of California, Berkeley

INTERACTIVE ENVIRONMENTAL MODELING AND GRAPHICAL DISPLAY OF SPATIAL AND TEMPORAL DATA

Presented by: *Daniel P. Loucks*
Cornell University

CLOSED LOOP DYNAMIC TEST CONTROL USING AN IBM PC-AT

Presented by: *Jorge Sousa*
University of California, Berkeley

COMPUTER AUGMENTATION OF FLIGHT SIMULATOR TRAINING

Presented by: *Christopher Wickens*
University of Illinois

AGENDA (continued)

■

F-5 BIOLOGICAL SIMULATION III
Chairperson: *Robert J. Penka*
University of Illinois

DYNAMIC MODELS IN BIOCHEMISTRY
Presented by: *Sandra I. Lamb*
University of California, Los Angeles

CELL HOMEOSTASIS
Presented by: *Eric Jakobsson*
University of Illinois

INTERACTIVE COMPUTING IN THE TEACHING OF POPULATION GENETICS
Presented by: *Kenneth K. Kidd*
Yale University

COMPUTER MODELS OF PLANT MORPHOLOGY AND EVOLUTION
Presented by: *Karl J. Niklas*
Cornell University

X. PLENARY SESSION - TUESDAY, APRIL 8, 1986 8:30 - 9:30 A.M.

Good Morning *Al DeFlorio*

Robert M. Williams
Assistant Group Executive -Information Systems
and Communications Group
General Manager - Engineering Systems Products

Remaining Agenda *Al DeFlorio*

XI. SESSION G - TUESDAY, APRIL 8, 1986 9:30 - 11:00 A.M.

G-1 TUTORIAL: INTELLIGENT TUTORS
Chairperson: *John Goldin*
Yale University

AGENDA (continued)

G-1 TUTORIAL: INTELLIGENT TUTORS (continued)

INTELLIGENT TUTORS
Presented by: *Gregg Kearley*
Park Row Publishers

G-2 POLITICAL SCIENCE

Chairperson: *Jean Dexheimer*
Carnegie-Mellon University

SIMULATED POLITICAL ARENA (SPA)
Presented by: *Stevin J. Rosenstone*
Yale University

PDS — A SIMULATION OF COLLECTIVE DECISION MAKING
Presented by: *Mark Winer*
University of Maryland

DATABANK OF TREATY RESEARCH
Presented by: *Peter Rohn*
University of Washington

G-3 ARCHITECTURAL DESIGN APPLICATIONS

Chairperson: *Robin S. Liggett*
University of California, Los Angeles

GRAPHICS AND ANALYSIS FOR ARCHITECTURAL DESIGN
Presented by: *Lee B. Anderson*
University of Minnesota

INTEGRATED DESIGN SYSTEMS FOR THE IBM PC-AT INCLUDING A 3-DIMENSIONAL GRAPHIC PROGRAM, RULE BASED FRONT END, AND INTERFACES TO COMMERCIAL DRAFTING, SPREADSHEET AND DATABASE PACKAGES
Presented by: *Gerhard Schmitt*
Carnegie-Mellon University

VEGA: A GEOMETRIC MODELING SYSTEM
Presented by: *Rob Woodbury*
Carnegie-Mellon University

AGENDA (continued)

G-4 PHYSICS AND MATH

Chairperson: *Gerald J. Porter*
Cornell University

NEW ELEMENTARY PHYSICS LABORATORY EXPERIMENTS
Presented by: *Ulrich Kruse*
University of Illinois

COMPUTER GRAPHICS UTILITIES IN SPECIAL RELATIVITY
Presented by: *Edwin F. Taylor*
Massachusetts Institute of Technology

GEOMETRICAL AND PHYSICAL OPTICS
Presented by: *Ned S. Vander Ven*
Carnegie-Mellon University

CALCULUS SOFTWARE DEVELOPMENT ON THE PC AND RT - A COMPARISON
Presented by: *Russell C. Walker*
Carnegie-Mellon University

G-5 FOREIGN LANGUAGE

Chairperson: *Jacqueline D. Brown*
Princeton University

AN AUTHORING SYSTEM AS A TOOL FOR FOREIGN LANGUAGE LEARNING
Presented by: *Debra McGraw*
Cornell University

BILINGUAL WORD PROCESSING
Presented by: *James S. Noblett*
Cornell University

AGENDA (continued)

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G-5 FOREIGN LANGUAGE (continued)

SHARPENING LANGUAGE AWARENESS THROUGH THE RESTORATION OF WORDS DELETED SYSTEMATICALLY FROM TESTS: A LEARNING AND TESTING DEVICE TO SUPPORT INTEGRATIVE LANGUAGE TEACHING
Presented by: *John Barson*
Stanford University

SOFTWARE FOR PRINTING SOUTH ASIAN SCRIPTS
Presented by: *Donald A. Becker*
University of Wisconsin, Madison

XII. SESSION H - TUESDAY, APRIL 8, 1986
11:30 - 12:30 P.M.

H-1 RT PC SYSTEMS ARCHITECTURE
Presented by: *William J. Spalter*
IBM ACIS

H-2 THE INTERLEAF WORKSTATION PUBLISHING SYSTEM
Presented by: TBA

H-3 RECENT ADVANCES IN A.I.
Presented by: *Frank C. Tung*

H-4 UNDERSTANDING AND USING THE GRAPHICS DEVELOPMENT TOOLKIT (VDI)
Presented by: *William G Tuel, Jr.*
IBM Palo Alto Scientific Center

H-5 ADDING DEVICE SUPPORT FOR AIX
Presented by: *TBA*

XIII. SESSION I - TUESDAY, APRIL 8, 1986
2:00 - 3:30 P.M.

I-1 PANEL: PROJECT EVALUATION
Chairperson: *Cliff Gillman*
University of Wisconsin

AGENDA (continued)

I-1 PANEL: PROJECT EVALUATION (continued)

TOOLS AND METHODOLOGY FOR EVALUATION OF INSTRUCTIONAL COMPUTING PROJECTS

Presented by: *Michelle Comeaux*
University of Wisconsin

STUDYING COMPUTER INTERVENTION IN A COLLEGE COURSE

Presented by: *William O. Beeman*
Brown University

EVALUATION FOR PROJECT OLYMPUS

Presented by: *Greg Zick*
University of Washington

I-2 MUSIC

Chairperson: *Chris Swisher*
University of Pennsylvania

COMPUTERIZED TEXT ANALYSIS AND DATABASE MANAGEMENT AS TECHNIQUES IN MUSICOLOGICAL ADVANCED STUDY

Presented by: *John Hill*
University of Illinois

THE MUSICIANS WORKBENCH: FOUNDATIONS FOR COMPUTER ASSISTED EDUCATION IN MUSIC

Presented by: *Roger Dannenberg*
Carnegie Mellon University

MUSICAL ACOUSTICS DEMONSTRATION/LESSONS

Presented by: *James Beauchamp*
University of Illinois

I-3 TEACHING ARCHITECTURAL DESIGN

Chairperson: *Robert J. Penka*
University of Illinois

AGENDA (continued)

I-3 TEACHING ARCHITECTURAL DESIGN (continued)

A "LANGUAGE LAB" FOR ARCHITECTURAL DESIGN

Presented by: *Arch MacKenzie*
Cornell University

EDUCATIONAL SOFTWARE FOR STRUCTURAL ENGINEERING

Presented by: *Irving Oppenhiem*
Carnegie-Mellon University

A MICROCOMPUTER DESIGN TOOL FOR LEARNING ENERGY CONSERVING

Presented by: *Murray Milne*
University of California, Los Angeles

I-4 MECHANICAL ENGINEERING

Chairperson: *J. Eaton*

DYNAMIC SIMULATION USING ADAMS2D ON THE IBM PC/AT WITH PROFESSIONAL GRAPHICS MONITOR

Presented by: *Richard C. Coddington*
University of Illinois

COMPUTERIZED INSTRUCTION IN ENGINEERING THERMODYNAMICS

Presented by: *S. A. Klein*
University of Wisconsin

THE USE OF INTERACTIVE THERMAL FINITE ELEMENTS (ITEM) IN AN UNDERGRADUATE HEAT TRANSFER COURSE

Presented by: *Ashley F. Emery*
University of Washington

A MICROCOMPUTER-BASED HYBRID SYSTEM APPROACH TO NEAR OPTIMAL DESIGN OF MECHANICAL COMPONENTS

Presented by: *David A. Hoeltzel*
Columbia University

AGENDA (continued)

I-5 INTERACTIVE VIDEODISK

Chairperson: *Cecilia M. Cowles*
Cornell University

INNOVATIONS IN HIGHER EDUCATION: A MULTIMEDIA DEVICE
Presented by: *Bruce Tettleman*
Columbia University

USING INTERACTIVE VIDEO TO DELIVER LECTURES AND TUTORIALS
Presented by: *Lynn D. Churchill*
University of Washington

THE USE OF INTERACTIVE VIDEODISK IN FOREIGN LANGUAGE LEARNING
Presented by: *Anthony J. Niesz*
Yale University

DESIGNING LEARNING MATERIALS FOR THE LANGUAGE LAB OF THE FUTURE
Presented by: *Janet Murray*
Massachusetts Institute of Technology

XIV. SESSION J - TUESDAY, APRIL 8, 1986
4:00 - 5:00 P.M.

J-1 RT PC SYSTEMS ARCHITECTURE

Presented by: *William J. Spalter*
IBM ACIS

J-2 THE INTERLEAF WORKSTATION PUBLISHING SYSTEM

Presented by: *TBA*

J-3 RECENT ADVANCES IN A.I.

Presented by: *Frank C. Tung*

AGENDA (continued)

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J-4 UNDERSTANDING AND USING THE GRAPHICS DEVELOPMENT TOOLKIT (VDI)

Presented by: *William G Tuel, Jr.*
IBM Palo Alto Scientific Center

J-5 ADDING DEVICE SUPPORT FOR ACADEMIC INFORMATION SYSTEMS

Presented by: *TBA*

ROBERT M. WILLIAMS
ASSISTANT GROUP EXECUTIVE — INFORMATION SYSTEMS & COMMUNICATIONS GROUP
GENERAL MANAGER — ENGINEERING SYSTEMS PRODUCTS

Mr. Williams began his career with IBM in September, 1962, as a Marketing Representative in the Rochester, New York branch office. After holding a variety of marketing and staff positions, he became Administrative Assistant to the President of the Data Processing Division in July, 1974. In February, 1976 he was named Director of Public Sector Industries located in Washington, D.C. He became Group Director of Systems Planning, DP Product Group, in June, 1979; and in June, 1981 was appointed Group Director of Engineering Systems Products. He was named General Manager of the Engineering Systems Products Independent Business Unit in September, 1982, and Assistant Group Executive IS&CG in March 1985.

Mr. Williams was graduated from Cornell University with a BEE in Electrical Engineering in 1961 and a year later received his MBA from Cornell in Business Management.

Bob, his wife, Karen, and their three children reside in Weston, Connecticut.

RAYMOND L. ORBACH

PROVOST
COLLEGE OF LETTERS AND SCIENCE
UNIVERSITY OF CALIFORNIA, LOS ANGELES

Since receiving his doctorate in physics from the University of California. Berkeley, Dr. Orbach has been a National Science Foundation Postdoctoral Fellow at Oxford University, an Assistant Professor of Applied Physics at Harvard, and an Associate Professor and Professor of Physics at UCLA. He has also held teaching positions in Belgium and France, and has been a John Simon Guggenheim Foundation Fellow.

Dr. Orbach has been a member of numerous professional committees, including the National Science Foundation Panel for Physics, the National Commission on Research, and the Solid State Sciences Committee of the National Research Council. In addition, he has been chairman of the Gordon Research Conference on Quantum Solids and Fluids, the Sixteenth International Conference on Low Temperature Physics, and the Nominations Committee of the American Physical Society.

Dr. Orbach also serves on the editorial advisory board of the *Journal of Low Temperature Physics* and *Magnetism Letters*, and is divisional editor of the *Physical Review.*

PRESENTATION

ABSTRACTS

RT PC HARDWARE AND AIX SYSTEM SOFTWARE

Presented by: *TBA*

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A discussion of the capabilities of the processor and peripherals of the RT PC hardware and the primary components of the AIX operating system software.

DEVELOPING INTERACTIVE GRAPHICS APPLICATIONS WITH graPHIGS

Presented by: *William G. Tuel, Jr.*
IBM Palo Alto Scientific Center

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graPHIGS is a powerful programming interface to a wide range of graphics devices, from plotters to the IBM 5080. Its imminent standardization makes it a likely candidate as a subsystem interface for interactive graphics applications.

But to use graPHIGS effectively, one has to understand the functions provided and design the graphics application to take maximum advantage of these functions.

In this talk, some of the major graPHIGS concepts will be illustrated, including the graphical data model, viewing, attribute bundling, and operator selection of graphic structures. The presentation will indicate which types of applications are well suited for using graPHIGS, and which may require an alternate graphic interface. The speaker's own experience in developing graPHIGS applications will be related.

AUTHORING SYSTEMS

Presented by: *TBA*

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A look at a variety of authoring systems and an evaluation of authoring methodology and technology.

ACADEMIC INFORMATION SYSTEMS 4.2 AND ANDREW

Presented by: *TBA*

■
A discussion of the functional capabilities of Academic Information System 4.2 and the integration of and capabilities of Andrew.

A4 IBM TECHNICAL PRESENTATION

IBM WORKSTATION NETWORKING OPTIONS AND FACILITIES

Presented by: *TBA*

IBM has two networking offerings, Token Ring and PC network. A discussion of each will clarify the functional differences.

PROPOSED AEP SOFTWARE DISTRIBUTION CENTER

Chairperson: *Jacqueline Brown*
Princeton University
Presented by: *Tad B. Pinkerton*
University of Wisconsin

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TUTORIAL: ROUNDTABLE IN SIMULATION METHODS

Chairperson: *Chad K. McDaniel* (301)454-8695
University of Maryland
Panelist: *J.D. Welsh*
Princeton University

This roundtable will provide those new to microcomputer-based simulation with an overview of simulation types and methods. The session will consider the range of things called simulation and the conceptual issues underlying appropriate simulation design and use.

The types of simulations discussed will include:

- Domain simulations, e.g., simulations of processes found in the physical, social, or biological sciences;
- Instrument simulations, e.g., simulations of scientific instruments or laboratory experiments;
- Role-playing simulations, e.g., simulations in which the computer assists students in role-playing situations/games by adopting a role and/or by structuring/managing the interaction among the players.

The Roundtable/Tutorial will have two components:

- An overview, presented by Dr. McDaniel, of simulation methods, styles, and issues, including a unified perspective on the above types of simulation.
- Roundtable discussion of the appropriate uses of simulation in the classroom, including the perils, pitfalls, limitations, and strengths of education-oriented simulations.

PANEL ON THE IMPLEMENTATION OF GRAPHICS APPLICATIONS

Chairperson:	*Jim Poage* Princeton
Panelists:	*Kirk Alexander* Princeton *Reggie Caudill* University of Alabama *Jim Morris* Carnegie-Mellon University

■

This session will bring together three speakers who have each played a major role in designing and directing a large scale graphics application development project. Each speaker will present the nature of his or her project and discuss various issues in the funding, organizing, implementation of the activity. The nature of the graphics activity obtained will also be emphasized.

PANELISTS:

Kirk Alexander: Princeton University (609)452-5420

Kirk will give a brief description of the role that the Interactive Computer Graphics Laboratory has played at Princeton University and the direction the lab is taking today. He will then discuss the 5080 project currently underway in the lab and the implications this project has for graphics applications development in the future. The focus will be on the tools the lab wants to develop to make graphics "productive" in the classroom.

Reggie Caudill: University of Alabama (205)348-6324

Dr. Caudill is responsible for having implemented a 5080 graphics lab at a non AEP school entirely with local or other industrial funds...the non IBM grant perspective. He will discuss how this was managed and what direction the lab is currently taking.

TUTORIAL: CMU-Tutor

Presented by: *Bruce Sherwood* (412)268-8530
Carnegie-Mellon University

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The personal computing project at Carnegie-Mellon University has the ambitious goal of deploying several thousand machines of the class of the IBM RT PC, Sun, or Digital MicroVax high-function workstations. The major force behind this project has been the Information Technology Center, funded by IBM, which has built the Andrew software system on top of Berkeley 4.2 Unix. Andrew includes a campus-wide file system, a window manager, a powerful document-processing subroutine library, and a powerful database-manipulation subroutine library.

For the success of the project, it is important that many people, including non-expert programmers, be able to write application programs based on the Andrew system. Before the creation of C-MU Tutor, it was difficult for non-expert programmers, writing in C, to exploit the interactive graphics capabilities of Andrew. Major problems included:

1.) It takes several minutes to compile and link a C program; making it cumbersome to check out minor changes to programs.

2.) The Andrew text editor supports fancy text options (italic, bold, centering, etc.), but the C compiler cannot cope with such text in a C program.

3.) Various drawing editors could be used to add graphics to printed articles, but there was no graphics editor integrated with C programs, so all graphics programs had to be designed on paper.

4.) The error diagnostics provided by the C compiler and linker are often very cryptic. A typical example is "syntax error in line 247" due to a missing brace or comment delimiter on line 43.

5.) Andrew assumes that each application program will rescale its graphics and text presentations to fit whatever window size the end user allocates to the program. This puts an enormous burden on the applications programmer.

6.) While there is on-line help for many aspects of Unix, there is no on-line reference manual for the C language itself, where a programmer could quickly find information on language constructs.

Continued

To solve these problems, my wife Judith Sherwood and I have implemented C-MU Tutor, a version of the MicroTutor Language developed in the PLATO project at the University of Illinois (where we worked before coming to C-MU in January 1985). Its properties include:

1.) The C-MU Tutor Language is incrementally compiled, so that the effect of a change is visible in a few seconds, yet the execution speed is comparable to that of a compiled language.

2.) The full Andrew text capabilities can be used in C-MU Tutor source code.

3.) A graphics editor is very tightly coupled to the programming language: not only can one create pictures on the screen and have source code generated, but it is very easy to modify the display graphically. The graphics editor is almost entirely transparent in use, in that no special command language is required.

4.) Error diagnostics are highly specific and pointed out to the nearest character position.

5.) Two lines of code are sufficient to invoke automatic rescaling of text and graphics, including the option of whether to preserve aspect ratio.

6.) An on-line reference manual for C-MU Tutor not only permits locating information hierarchically (from the top down) or by command (from the bottom up), but one can use the standard Andrew mouse-oriented editing capabilities to copy program segments into one's workspace and execute the code immediately, making this manual highly interactive.

A number of people have begun using C-MU Tutor for various programming tasks, including computer-based instruction, general research programming, and the preparation of animated slide shows. The conference presentation will consist of actual programming of various kinds of program sequences, including static and dynamic graphics, sequencing (including the use of pop-up menus), and analyzing verbal and mathematical inputs.

SYMPOSIUM: NETWORKING WORKSTATIONS TO MAINFRAMES

Chairperson: *Cliff Gillman*
University of Wisconsin
Panelists: *Richard Cogger*
Cornell University
Susan Greenberg
University of Illinois
Phil Long
Yale University
Glenn Ricart
University of Maryland

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A presentation of the activities on each campus directed towards networking of PC's to mainframes. The presentation from each panelist will be followed by a general discussion with questions and answers.

BEYOND AEP

Chairperson:	*Norman N. Mintz* (212) 280-2488/2489 EVP Academic Affairs, Columbia-Chmn.
Panelists:	*Robert Barker,* Provost, Cornell *Albert P. Barber,* V Chan. Research, UCLA

The Advanced Education Projects supported by IBM at the several universities are making significant contributions to the educational, research and conservation missions of those institutions. However, they also have introduced university administrators to a partial but fuller understanding of the financial costs associated with the widespread introduction of technological innovation in the university. Universities are by nature conservative institutions and it is very difficult to reorder an institution's financial priorities, in a short period of time, to accommodate the cost of technology. IBM's contributions of support to these institutions, while extremely generous by any standard, has merely whetted the appetite of the university community for more and better technological support.

Three senior university administrators will comment from their perspective on the nature and, to the extent that they can glimpse them, the solutions to these problems, and will discuss their perceptions with the audience.

ROUNDTABLE DISCUSSION ON FOREIGN-LANGUAGE PROCESSING

Chairperson:	*C.M. Sperberg-McQueen* Princeton University
Panelists:	*Slava Paperno* Cornell University *Janet Murray* MIT *Nina Garrett* University of Illinois

■

The session is intended to provide an overview of the problems involved in data processing when the data involved are words or texts in a natural language other than English. Singled out for particular attention are the ubiquitous and recurrent problem of character sets (design, display, printing, integration into applications) and the issues involved in computer-assisted language learning (which is probably the most common foreign-language processing application on university campuses).

The speakers are:

C. M. Sperberg-McQueen, Princeton University Computer Center
Official and de facto character set standards, their promise, their problems.

Slava Paperno, Cornell University,
Problems in foreign-language processing: character sets, character display and printing, case distinction, accessing character sets from within application programs, punctuation and layout conventions, sorting problems.

Janet Murray, Massachusetts Institute of Technology

Developing materials for the Language Lab of the Future: integration of artificial intelligence and speech recognition into foreign-language instruction.

Nina Garrett, University of Illinois at Urbana/Champaign

Psycholinguistics and foreign-language instruction.

TO BE ANNOUNCED

Presented by: *TBA*

■

DESIGNING AN EFFECTIVE LOCAL AREA NETWORK FOR INSTRUCTION

Presented by: *Randy Siler* (206)543-0751 S6368@UWAVM
University of Washington

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The purpose of this project was to configure a microcomputer laboratory with a local area network so as to maximize the efficiency of the IBM PC Network in an instructional environment. Issues related to the use of the network by both novice and experienced users were addressed. Since many of the user's of this network are inexperienced, it became desirable to configure the network to be as "transparent" as possible. Developments resulted in a significant reduction of time to boot the system and the establishment of a network that has quick access to major application packages, communications, etc. with single English word commands. The tuning of the network to meet the demands of an instructional environment became a major study in itself.

With respect to the configuration of the network, the general strategy was to identify the parameters of the server and the individual workstations to increase the performance and functionality of the network. These adjustments also had to consider the issues of maintainability, flexibility, and economy. The changes to improve functionality were structured into the localities of the directory structure, the config. sys. files, the autoexec files, and the autouser files. Modification of a number of parameters have significantly impacted the performance of the network.

A multitude of classes have used the instructional laboratory, and it has consistently met with praise from both instructors and students for its "efficiency" and "ease of use". Other units on the University of Washington campus and visiting faculty from other colleges have used this facility as a model for their future network configurations. The most critical aspects of the design of this laboratory and results of this study will be reported.

DESIGNING LOCAL AREA NETWORKS FOR THE ACADEMIC ENVIRONMENT

Presented by: *Stuart Bogom* (215)898-6713 PORTER@PENNDRLS
University of Pennsylvania

Local area networks (LANs) offer an efficient and cost effective means for the delivery of microcomputer services to users. However implementing LANs in any environment is not trivial; the academic environment is particularly difficult because of the multiple roles a LAN may be called on to play (educational support, research support, and office automation functions). This presentation describes the successful installation of a 20 node IBM PC Network at the Population Studies Center, University of Pennsylvania. The topics covered include: 1) the promise and the danger that LANs present in an academic environment, 2) evaluating LAN needs based on computing demand, user sophistication, and hardware/software requirements, 3) issues in the design of the LAN-user interface in order to provide simple and effective delivery of educational, research, and office automation tools.

DESIGN SUPPORT SYSTEMS FOR ARCHITECTS AND PLANNERS

Presented by: *Joseph Ferreira, Jr.* (617)253-7410 JF@MIT-ATHENA
Massachusetts Institute of Technology

As part of MIT's Project Athena, the School of Architecture and Planning is developing a networked design support system with graphic and analytic tools suited to educating architects, planners and real estate developers. The effort is in the middle of three stages: (a) straightforward use of off-the-shelf DOS software for drafting, spreadsheets, text processing and data analysis, (b) building, linking and reshaping software tools to enhance their educational benefit in design and analytic modeling contexts, and (c) providing a stimulating laboratory environment in which students can invent and explore design alternatives and discover modeling concepts using multi-media tools that take advantage of Project Athena's network and advanced workstations.

At present, more than a dozen faculty and a few hundred students are making extensive use of the Project Athena facilities that are housed in the School's Computer Resource Lab. The CRL has 30 ATs and XTs on a local ethernet with a VAX 11/750 server and assorted peripherals and gateways to the rest of Project Athena.

The presentation will (a) review the educational goals and development strategies of this effort, (b) demonstrate examples of class exercises and student projects involving analytic modeling, site planning and architectural design, and (c) focus on two specific themes: (1) using spreadsheets to provide an exploratory environment for discovering modeling concepts, and (2) building complex tools for computer-aided-design and geographic information systems by linking together graphic editors, data base managers and analysis packages that are suitably open and extensible.

NETWORKING TO SUPPORT EDUCATIONAL OBJECTIVES

Presented by: *Michael K. Stenstrom* (213)825-1408
University of California, Los Angeles

UCLA's School of Engineering and Applied Science's networking project (SEASnet) was developed with the primary objective of providing a mechanism for students and faculty to share computing resources. In order to provide transparent access to resources and to avoid the time and frustration associated with learning several operating systems, a single distributed Unix operating system, LOCUS, was selected for all the mini and mainframe computers. PC-DOS and Unix were selected as operating systems for workstations. Since the project's conception, a network of 3 IBM 43XX machines, 15 DEC VAXen, and 120 PC-At's has been assembled. TCP/IP Ethernet and some specialty protocols connect the machines.

This paper will provide an overview of the software projects undertaken to provide transparent access to resources. The following items will be discussed:

1.) Remote file systems on 43XX machines for PC-DOS workstations.

2.) Remote job entry from workstations.

3.) Dynamic load allocation and transparent file access among 43XX's.

4.) Integration of mainframe software from IBM-MVS systems to Unix and PC-DOS workstations.

5.) New tools for system administration of large user groups in a Unix environment.

6.) New techniques for electronic class management, such as making and collecting assignments in a large distributed Unix environment.

The presentation will be accompanied by a demonstration of LOCUS through a modem connection to SEASnet. Remote file systems and load management will be demonstrated.

ROUNDTABLE/TUTORIAL ON MANAGEMENT AND SOCIAL ISSUES
IBM AEP Conference 1986

Chairperson: *Gerald J. Porter*
University of Pennsylvania
Panelists: *Patricia Burton Helm*
University of Pennsylvania
Michael S. Mahoney
University of Illinois
Michael Pleck
Princeton University

The session will describe a number of the social and management issues that arise when personal workstations are made available to large numbers of students. Two of the speakers are responsible for classrooms/workrooms in residential colleges. The third is responsible for a 35 machine network supporting a number of courses.

The speakers are:

Patricia Burton Helm, University of Pennsylvania

Computers in Residences: Social and Managerial Issues

The Threshold Grant has provided Hill College House with a computer classroom equipped with fourteen IBM PCs and two IBM XTs. Our project objective was to develop a microcomputer classroom as the focal point for formal and informal academic computing in a predominately freshman residential community of 560 students. This objective was a natural outgrowth of the philosophy of Hill College House, which uses residential and dining arrangements along with a network of affiliated faculty members, to build an active intellectual and cultural community among its residents. Although Hill's seminar facilities have hosted courses and course sections from a variety of undergraduate schools and departments during the past fifteen years, the Threshold Project was aimed at enriching the residence-affiliated curriculum with the inclusion of new courses pioneering computer applications across a broad spectrum of academic disciplines.

Hill's computer classroom allows faculty to conduct classes in the facility during the day, then during non-class hours provides with a facility for completing class projects and computer-work for other, non-affiliated courses. Our primary interest has been to work with faculty who are developing undergraduate courses in disciplines which have not, until recently, used the computer as a basic teaching tool. Examples include history, linguistics, economics, sociology, religious studies, and English. With our

Continued

access to mainframe units in both the School of Arts and Sciences and the Engineering School, students can use databases beyond the capacity of the PC. Almost any discipline, therefore, has the potential to become part of our curriculum.

My paper will describe some of our present courses and the ways in which students use the computer facility in their undergraduate studies. It will then address several key issues in managing such a facility: security, access, maintenance of the room, equipment and educational supplies, and training and supervision of staff. It will also focus on the most crucial issue in such a program which is, of course, the recruitment of faculty to develop appropriate computer-based classes and marketing the curriculum and the facility to freshmen and other undergraduates, most of whom have little or no hands-on computer experience.

In addition, I will discuss some additional educational benefits of such a residence-based classroom, including: extended hours for student access and broader availability of class materials; opportunities for student-faculty interaction outside of class hours (both in the classroom and over meals); expanded opportunities for students to help each other in learning basic computer applications.

Michael S. Mahoney, Princeton University

The Forbes College Computer Center is an experiment in convivial computing. Sited in one of Princeton's new underclass residential colleges but linked to the university system, it aims to make the computer part of an integrated social and academic enviornment. Ready and assured access to a full range of computing services, combined with a program of classes and clinical assistance, will, we hope, encourage students to explore the computer not only as a means of making traditional tasks easier but also as a vehicle for expanding their intellectural experience beyond traditional limits. So far, classes have proved to be less important to students in learning how to do things with computers than has collegiality; as we suspected, students learn best from one another while on task. But students seem willing to take the time to acquire only those computer skills that manifestly facilitate their work, in most instances work processing. They seem less eager than we had hoped to explore new uses, and it seems likely that significant new applications of the computer to the university curriculum will have to come from the faculty.

Michael Pleck, University of Illinois

Professor Pleck will be talking about a classroom environment consisting of 35 networked machines. He expects to describe how the system was packaged for use by the students; the user interface for teaching. A great deal of effort was spent in planning how to measure the effectiveness of the project. The planning, the measurements made to determine effectiveness, and the early results of those measurements will be described. Finally, he will present some observations on how the use of the equipment has changed the teaching of the courses.

WINDOWS & GEM

Chairperson: *Howard Rumsey*
California Institute of Technology
Panelists: *Paul Davis*
Microsoft Corporation
Don Anderson
University of California, San Diego

TUTORIAL: PROGRAMMING BEYOND TURBO PROFESSIONAL GRAPHICS CONTROLLER

Chairperson: *D. Riley*
University of Minnesota

Presented by: *Lee B. Anderson*
University of Minnesota

■
We have been using the convenience and speed of Turbo Pascal to develop small to medium-size programs which depend on fast access to all of the features available on the Professional Graphics Controller. Extended Pascal features provided by Turbo can be used to talk directly to the PGC to provide a much richer and faster graphics environment than that provided by VDI or GKS.

Our tutorial session will cover the following areas:

1) Creating routines which utilize the direct memory access provided by Turbo Pascal to write directly to the PGC. These routines provide very fast access to all of the PGC commands.

2) Including external assembly language routines in Turbo Pascal to speed vector and matrix operations using the 8087/80287. Although Turbo Pascal provides 8087/80287 support, some math operations can be made 2 to 4 times faster by including assembly language extern procedures available from several sources.

3) Using the PGC commands which are not available through VDI or GKS. The PGC provides a number of very useful features which can be accessed only by talking to the controller directly. We will cover the display list functions, 3-D manipulations and color look-up table "tricks".

TUTORIAL: DESIGN AND USES OF INTERACTIVE VIDEODISC TECHNOLOGY

Chairperson:	*Cecilia Cowles* Cornell University	(607) 256-4981
Presented by:	*Geri Gay* Cornell University	
Coauthor:	*Stan Smith* University of Illinois	
Panelist:	*D. Lieberman* Stanford University	

■

One of the newest forms of computer-assisted instruction is the interactive videodisc. Some of the major features of the videodisc system are random access to a variety of information (video images, audio sequences, variable speed display, graphics, animation, etc.) and a high degree of learner interaction. The video component can add visual and audio presentation to the interactive components of the microcomputer -- components such as learner control, feedback, branching, and record keeping. Furthermore, intelligent videodisc systems provide an unprecedented opportunity to develop new ways of representing information in ways that are most conducive to learning.

The purpose of this session is to provide an overview of interactive videodisc instruction. The session leaders will emphasize special theoretical and design requirements for interactive media, planning, production, and applications. The format of the workshop is as follows:

a) What is interactive video?
b) How does it work?
c) What kinds of skills are needed to develop interactive programs?
d) What are the special design requirements?
e) Is it efficient and effective?
f) What are some effective applications of interactive videodisc systems?

REMOTE ELECTRONIC MUSIC SYNTHESIS WORKSTATION

Chairperson: *W. Danielson*
University of Texas
Presented by: *Russell Pinkston*
University of Texas

■

Much of the previous work in the field of Computer Music has focused on technical problems in the digital manipulation of sound. Although this research has vastly improved the quality of both the hardware and software available for digital sound synthesis and signal processing, it has tended to ignore some fundamental problems with the "user interface." The most significant obstacle facing composers in this field has been the general lack of systems and software which are specifically designed for use by musicians. Aside from the inherent complexity of the subject matter, which often seems forbidding to users who do not have a technical background, the greatest impediment for the novice computer musician is often the extreme inconvenience of the working environment. The digital synthesis and processing of music requires huge amounts of storage and even larger numbers of calculations. Hence, access to a big, fast mainframe computer has historically been a sine qua non of real "computer music." In addition, the digital output produced by the music programs must then be converted to sound. This is a "real-time" process, which cannot take place in the "time-sharing" environments of most mainframe computers. Consequently, unless the user has access to a "dedicated" computer music system, the music synthesis usually take place on one computer and the conversion to sound on another. The remote synthesis workstation being developed at UT-Austin would allow users to edit their programs in a software environment tailored for the musician, and to test their sounds at the terminal in a quiet room that is conducive to creative thought.

TUTORIAL: SOFTWARE DESIGN PRINCIPLES FOR INSTRUCTIONAL APPLICATIONS

Presented by: *Stanley R. Trollip*
University of Minnesota

■

Historically, the quality of instructional software has not been very good. Generally, there have been two major reasons why this has been the case: either the instructional aspects of the software have been inappropriate for the medium or the programming has been poor, resulting in program malfunctions. This tutorial session will concentrate on the instructional aspects of producing courseware.

The first part of the session will concentrate on the important cognitive issues that should influence software design. We will discuss how to determine what instructional approaches are most appropriate for particular applications. We will also briefly touch upon the effects of screen design on learning. A number of good and bad examples will be shown.

In the second part of the session, we will discuss an instructional design model that provides clear guidelines for taking an instructional idea from its incipient stage to being a polished, finished product. Each of the steps in the model will be explained, both in terms of what they accomplish, as well as how they contribute to the overall quality of the final product.

DEMOGRAPHIC MICROSIMULATION

Presented by: *Chad K. McDaniel* (301)454-8695
University of Maryland

A common and important dichotomy that pervades the social and behavioral sciences is the between group and individual. Practitioners of history, economics, anthropology, and political science often divide between those who take statistical/population-oriented/"scientific" approaches and those who take case-study/individual-oriented/humanistic approaches. Demographic-sociological microsimulation provides an important tool for bridging the gap that often exists between group and individual behavior.

QSIM is a quick, queriable demographic microsimulation environment, having originally, conceptual roots in the Berkeley SOCSIM system. Whereas SOCSIM was a mainframe research tool, QSIM provides students and other researchers with a desktop laboratory for simulating and examining large numbers of life histories of interacting individuals. The simulated populations are composed of discrete individuals experiencing discrete births, deaths, and marriages with their own discrete genealogical and extra-familial social networks.

Using QSIM, students can develop and test a wide variety of historical, anthropological, demographic, and sociological hypotheses regarding the interaction of kinship, social structure, demographic behavior (birth, death, marriage, fertility), and cultural rules (e.g., incest taboos). QSIM gives students control over populations modeled. These can include historical populations (e.g., Black-Death ravaged 14th century Florence or 18th century Paris); contemporary populations studied by anthropologists or sociologists; or even theoretical populations outside of the normal biological or social bounds of known human societies. Both group outcomes and patterns of individual decision making can be studied using QSIM.

Additional efforts now underway will also be described, including an attempt to embed this simulation engine in a more general interface system that facilitates input of simulation control parameters and aids the display and analysis of simulation results, and an effort to integrate micros, mainframes, and supercomputers in a hierarchy of networked QSIM simulation resources.

QSIM is written in Pascal and runs on the IBM PC-AT.

THE GREAT AMERICAN HISTORY MACHINE

Presented by: *David Miller* (412)268-2876 BM61@TD.CC.CMU.EDU
Carnegie Mellon University

In this session David W. Miller, Professor of History, Carnegie-Mellon University, would demonstrate a prototype of the Great American History Machine (GAHM), a software package being developed on ANDREW for use in the teaching of American History. When completed, GAHM will display an outline map of the United States and a scrollable list of socio-economic variables taken from the U.S. census and political variables constructed from presidential election returns. The user will choose (or construct from several existing variables) a variable to be displayed. A histogram of the variable will appear in a legend pane below the map, and the map will be tiled in shading patterns corresponding to the value of the variable for each county in the country. The user will be able to zoom in on the map and pan it across the screen. He/she may reset the cutpoints between different shading patterns by a sequence or mouse clicks in the legend pane. It will also be possible to pop a region of the map up into a pane covering the left half of the original map pane and display a second variable in a map of the same region on the right half of the pane. Ultimately we intend to make data from every census since 1840 and every presidential election in that same period accessible on GAHM. At the moment the prototype uses a small, precoded subset of the data in the 1850 census and has most of the capabilities outlined above.

We intend to develop a wide variety of specific exercises for students using this utility. It enables the user quickly to discern patterns in immense volumes of data and to begin to formulate very interesting hypotheses for further investigation. There are also plans to extend GAHM's capabilities by incorporating analytic tools suggested by recent developments in statistical geography. These enhancements would make the utility extremely valuable in research as well as teaching.

RECONSTRUCTING A HISTORICAL COMMUNITY

Presented by: *Myron P. Gutmann*
University of Texas, Austin

DESCRIPTION: This is an experimental research seminar offered by the Plan II Honors Program of the College of Liberal Arts, and the Department of History. Its goal is to introduce students to interdisciplinary work in history and the social sciences through the reconstruction of the history of a Texas community from the mid-nineteenth century until the 1930s. The base of this project will be the analysis of a microcomputer data base representing the population of the community throughout the period. To this demographic data we will add information about hereditary diseases; wealth, occupation and economic activity; and political activity. Each student will write a final paper analyzing one facet of the data. The papers will be collected in a book. The microcomputers requested in this proposal will be used to build the data base, to analyze it both statistically and graphically, to communicate with mainframe computers, and to prepare papers and reports.

INTERACTIVE COURSEWARE SIMULATION FOR FRUIT FARM MANAGERS

Presented by: *Emily Hoover* and *Albert H. Markhart, III*
University of Minnesota

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Optimal farm management requires timely decisions to respond to critical environmental and economic conditions. The education of prospective small fruit farm managers is often limited to the discussion of simplified "Do this when this happens..." statements. In addition, practical experience is often prohibited by cost and time. To provide the student with an opportunity to experience and appreciate decision-making in growing strawberries, we developed an interactive computer simulation which provides the student with immediate feedback on the consequences of the decisions made throughout a growing season.

The initial version of the simulation presents the student with a typical strawberry farm of 20 acres divided among 4 cultivars. One of three possible weather scenarios are selected and the probable occurrence of random meteorological and economic disasters. The simulation runs for 35 weeks beginning in April and running through November. Each week the student is given a weather forecast and other relevant information on current crop and economic conditions. The student then makes management decisions based on climate and crop status. The financial cost of the decision is calculated based on current prices and student selected quantities where appropriate. The effect on crop yield is determined from estimates by experts in the field based on crop status and climate (heat units and soil moisture). The computer then determines soil moisture, cumulative heat units and crop status for the next week of the simulation based on weather scenario and management decisions. The student completes 35 weeks of the simulation and then receives an economic analysis of the fruit farm. Costs and income are summarized and the bottom line profit determined. This is compared to the ideal performance possible based on the weather. The student is then presented with a week by week review and analysis of all decisions, a rationale of the consequences and a recommendation of what would have been more appropriate.

SIMULATING PREHISTORIC HUNTING PRACTICES

Presented by: *John Rick* (415)497-1854
Stanford University

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Simulation of animal response to hunting by humans stressing population dynamics. Output indicates relative productivity and stability of different hunting practices and predicts the archeological record (data) that will result from any given technique. The predictions are matched against the archeological record of early hunter - gathers site from high attitude Peru.

As a result, it is found that the early people developed very effective game management techniques and conservative hunting practices.

Developed on PC XT and in use in the Anthropology classes taught by Dr. Rick.

REPRESENTATION OF DENSITY DISTRIBUTIONS ON A SPHERE WITH COLOR GRAPHICS ON AN IBM PC XT

Presented by: *Lars Stixrude* (415)624-7431
University of California, Berkley
Coauthors: *H. R. Wenk*
University of California, Berkeley

Density distributions on a sphere are used in many fields of earth science. Geophysicists represent gravity variations or earthquake densities on the earth, structural geologists plot the direction of poles to bedding planes or foliation on the sphere, crystallographers represent the directional dependence of tenser properties such as elasticity. We have been concerned with the representation, in the form of pole figures, of the preferred orientation of crystals in deformed materials. Traditionally, density variations on a sphere have been contoured and then plotted with a X-Y pen plotter. This is time consuming and the visualization of the topology being represented is unsatisfactory, especially for students in a learning environment.

We have now designed an interactive FORTRAN graphics program which, instead of producing a contour diagram, produces a color-coded map of density values on the sphere. The results are less time consuming and the data are more easily visualized. The program uses a regular grid of density values on the sphere as input and projects the sphere either in equal area or stereographic projection. Then by interpolation, a density value is assigned to all cells of the graphics display (up to 640x350 cells for Enhanced Color Graphics or up to 640x480 for Professional Color Graphics). Each density value is then color coded (16 colors for Enhanced Color Graphics or 256 colors for Professional Color Graphics) and imaged on the Enhanced Color Display or a Professional Color Display. Two spherical projections are displayed next to each other to permit direct comparison. For example, experimental and theoretical data may be compared visually. The program may be used both for teaching and for research in a large number of interdisciplinary fields some of which have been mentioned above. Minimal equipment requirements are an IBM XT with Enhanced Color Graphics. Best resolution is obtained with Professional Color Graphics. Execution time is greatly reduced by using an IBM AT instead of an XT.

CRYSTALLOGRAPHY IN GEOLOGY

Presented by: *Ed Mulligan* (206)545-2248
University of Washington

Crystallography is a well defined but important topic in Geology. Most minerals can be identified by their shape, symmetry, and include mirror planes, glide planes, inversion centers, screw axis, and axis of rotation. All possible crystal shapes belong in the seven crystal systems, which have a total of thirty-two symmetry groups. Each of the thirty-two point groups are defined by a different minimal set of symmetry operators. The angles of the crystal faces are described by a notation called Miller Indices. Given the symmetry for a crystal, and the Miller Indices of a few key faces, the complete crystal shape can be drawn. Finding crystal symmetries and describing the angle of crystal faces are two difficult topics for the introductory student. The "CRYSTAL" program produced by the Department of Geological Sciences at the University of Washington under the auspices of the IBM Olympus Grant provides the user with the ability to perform real time three dimensional color graphics computer modeling of crystals. The user selects the crystal system point group, and then enters the orientation of the required crystal faces. The "CRYSTAL" program will then generate the crystal shape, displaying the crystal on the left side of the screen with hidden lines in a different color. The right half of the screen displays a Wulff Stereonet of the crystal, aiding the student with the 3D interpretation. By using the arrow keys on the numeric keypad, the crystal can then be rotated to any view, in real time, with the corresponding update of the stereonet clearly showing the symmetry elements of the crystal. A special option available to advanced geology students is the capability of generating optical interference figures in 16 colors on the same screen with the crystal and stereonet. Interference figures are used to help identify mineral grains found in rock thin section mounts by using the petrographic microscope to view the thin sections. The crystal orientation in relation to the refraction indicatrix has subtle but profound effects on the interference produced in a petrographic microscope, an important concept for the more advanced geologist, but often times difficult to demonstrate as one rarely finds a mineral grain with the proper orientation to illustrate the point being made.

INTERACTIVE GRAPHICS FOR DISPLAY AND ANALYSIS OF EARTHQUAKE SEISMOGRAMS

Presented by: *Anthony Lomax* (415)642-3977
University of California, Berkeley

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At the Seismographic Station we are developing an interactive graphics package using the IBM Professional Graphics Display to serve as a general tool for displaying and analyzing the ground motions due to seismic waves. The graphics package is designed to improve upon present display methods, to give fast, easy access to a multitude of seismic data processing techniques and to integrate with our IBM-PC based digital data acquisition and database systems. The graphics allows the vivid display of seismic wave properties for teaching and is a flexible, easy-to-use tool for exploratory and routine analysis of seismic phenomena.

The design of this package involves careful consideration of color, symbols, program flow and speed of execution. Colors are varied to depict a four-dimensional data set on the two-dimensional screen surface. Symbols are used to prompt the user and to depict data scaling and the current reference frame. program flow is as unrestricted as possible to give the user complete flexibility in shaping and exploring the data set. The special features of the IBM Professional Graphics Board are invoked when necessary to minimize processing and display times when the data set is modified. Beyond this, the graphics package is being developed in an active teaching and research environment and so is continually evolving in response to practical needs.

SATELLITE IMAGE PROCESSING AND DISPLAY FOR UNDERGRADUATE USE

Presented by: *Ronald J. P. Lyon* (415)497-5851
Stanford University

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The educational goal is to increase the accessibility of undergraduates to image processing and display tools (AS 133). Data are satellite coverages of the Stanford area and are used for environmental studies in this class analysis, which includes vegetation coverage, water pollution, urban growth, assessment of agricultural usage and mineral exploration. Includes system (B&W) for field analysis on portable PC.

SYSTEM/APPROACH:

XT or AT based system with Artist II and No. 9 color graphics boards. Developed in Fortran with assembler I/O for pan, zoom, joystick control (512X480X32 bits). Landsat data read directly from 1600 bpi mag tape. Cost of image units reduced from $250,000 to $15,000-$20,000 per unit.

RESULTS:

Good use acceptance by liberal arts students at Junior/Senior level, expanded lab planned. Demonstrations in France, South Africa, Australia. (see PC World 12/84, pg 256).

PC's IN THE ECONOMIC CURRICULUM AT YALE UNIVERSITY

Presented by: *Matthew D. Shapiro* (203)436-0605
Yale University

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The Economics Department at Yale is currently using personal computers as part of the curriculum in a wide range of undergraduate and graduate courses. This presentation will briefly discuss how personal computers are being applied in courses. It will then emphasize the pedagogical benefits of using personal computers in the place of more traditional educational materials and devices.

PC's are used in both the basic and intensive undergraduate statistics and econometrics courses. In the statistics courses, they are used in exercises that demonstrate graphically the Law of Large Numbers and the Central Limit Theorem. In the econometrics courses, they are used to give students a straight forward introduction to elementary data analysis. PC's are also used in the graduate econometrics to allow the students to easily compute complicated statistics not readily available in "canned" statistical packages.

PC's are being used to teach macroeconomic modeling. Students in special sections of introductory economics as well as in advanced seminars use the PC version of a macroeconomic model to trace out channels of economic behavior and to analyze the effect of government policies on key economic variables.

The PC's are not merely taking over the tasks of more traditional educational tools such as paper and pencil and mainframe computers. Instead, the PC's are allowing students to carry out exercises that could not have been implemented using the traditional tools.

COMPUTER ASSISTED LECTURES IN ECONOMIC THEORY

Presented by: *Steven M. Goldman* (415)642-2787
University of California, Berkeley

The project has developed microcomputer programs for the presentation of lecture material in economic theory courses. These programs are adapted for subsequent use by students to enable them to experiment with, and review, the course material.

Since economic theory most commonly is taught with the extensive use of diagrammatic representations of formal mathematical models, the orientation of the programs will concentrate on the development of graphical techniques suited to the presentation of economic material. The capacity to display the graphs for a particular model (and to view the resulting changes from modifications in the underlying set of parameters) affords a powerful expositional device for the discussion of a wide range of problems in both micro and macro analysis encompassing such techniques as:

1. comparative static and dynamic analysis
2. the existence and determination of partial and general equilibria
3. the displays of optimization techniques

Finally. various utilities are developed to support the display of economic models. The utilities concentrate on a.) those suited to aid in the development of the lecture programs themselves, and b.) general utilities to generate diagrams and graphical displays.

THE INS AND OUTS OF MACROECONOMIC FORECASTING: A TUTORIAL FOR STUDENTS

Presented by: *John Haltiwanger* (213)825-6619
University of California, Los Angeles

Students who go onto careers in business, government, or academia are likely to be potential purchasers of and users of macroeconomic forecasting services. Underlying the forecasting services is the forecasting model which consumers typically perceive as a black box. This set of computer exercises is intended to provide the student with some perspective on the type of macroeconomic forecasting models that are available and the pitfalls involved in forecasting. The exercises provide the student with the type of output forthcoming from macroeconomic simulation models and through an interactive program allow the student to manipulate the models. After guiding the student through several alternative macro simulation problems, the student is asked a series of questions to interpret the alternative simulations. These alternative simulations and the questions introduce the student to the notions of static and dynamic simulation as methods for gauging how good a model is. Moreover, the simulation problems and questions introduce, without requiring much statistical background, the notion of forecast errors and confidence intervals.

The current version of this software has been successfully used in two quarters of the intermediate macroeconomics with an average enrollment of 175 students. Students were provided with an extensive hand-out outlining the assignment and teaching assistants provided instructions in class sections. Each student was required to go to the micro computer lab, check out the software and complete the assignment on his/her own. The current version, while having been used in the classroom, is still under development. To date, the primary program is written in "C" and involves a shell which can incorporate several alternative macroeconomic forecasting models. Students first use the interactive program to generate the output from the simulations and then are automatically booted into LOTUS where the output awaits them for graphics. Macros have been written for LOTUS which accept the output and then in an interactive fashion ask the student what output to graph. Further allowing for direct comparisons across the alternative models, allowing the student to modify the specification of the models and improving the graphics.

NESTED FIXED POINT ALGORITHM

Presented by: *John Rust* (612)338-1331
University of Minnesota

The nested fixed point algorithm is a new statistical method, which estimates parameters of a wide class of discrete control processes. These processes involve a decision-maker who must at each time choose an action from a finite set of alternatives in order to maximize the expected value of an intertemporal objective function. A concrete example is the case of a bus manager who must at each time decide whether or not to replace a bus engine in order to minimize the discounted costs of operating the bus. The nested fixed point algorithm uses observed data to go "backwards" and infer the objective function the decision-maker is using. The algorithm does this with an "outer" optimization algorithm which searches for parameters of the agent's objective function which maximizes the likelihood function for the data. However, since the agent's dynamic objective function almost never has a tractable "closed-form" solution, we require an "inner" algorithm, which numerically solves the dynamic decision problem each time the outer algorithm produces new estimates of the objective function parameters. Elsewhere I have shown that the solution to the dynamic decision problem is equivalent to the computation of a fixed point to a contraction mapping, hence the name "nested fixed point algorithm". Although it is computationally intensive, this process of "revealed intertemporal preference" is important for testing the validity of dynamic economic theories, and for use in forecasting the behavior of decision-makers in the economy.

The theory underlying the nested fixed point algorithm is somewhat complicated, and there is some question as to whether the algorithm is even computationally feasible. As a result, I constructed software to implement the algorithm with two objectives in mind: 1.) to demonstrate that the algorithm is fast and effective even on microcomputers, 2.) to effectively communicate the theory underlying the algorithm to colleagues and students in econometrics. With the help of the new matrix programming language Gauss, I was able to almost effortlessly write software, which achieved both of these objectives. Since the elementary variables in Gauss are matrices and vectors, I was able to avoid the clumsy do-loops of Fortran, and write very compact programs, which provide almost 1-1 translation of the mathematical equations of the theory into executable Gauss code. Since Gauss commands are written in assembly code which is specially optimized for the 8087 processor, I was also able to write a program with high efficiency, computing up to 175 dimensional fixed points in less than 90 seconds. The resulting algorithm is fast enough (indeed almost too fast!) to be used for individual tutorials and classroom demonstrations to show students how the algorithm actually works. The software package is self-contained in the sense that it includes both the data and algorithms, which allow me to show how one formulates a rigorous

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econometric model beginning with initial processing of the "raw data", implementation of the theory into concrete computer code, and interpretation of the resulting data by graphical plots of the estimated objective functions computed by the nested fixed point algorithm.

My experience with this project has convinced me of the power and great educational potential of personal computers. It has enabled me to convert abstract theory in this new area of research into a concrete, self-contained software package, which brings the equations of the theory to life in front of the eyes of my students and colleagues. It has enabled me to speed up the dissemination of my ideas 100-fold.

SOFTWARE DEVELOPMENT STRATEGIES

Chairperson: *Jean Dexheimer*
University of California, Irvine
Panelists: *A. Bork*
University of California, Irvine
M. Carter
Stanford University
F. Hofstetter
University of Delaware
B. Sherwood
Carnegie Mellon University

CAMPS: (COMPUTER ASSISTED MEDICAL PROBLEM SOLVING) - THE DEVELOPMENT AND USE OF A SYSTEM TO TEACH AND EVALUATE MEDICAL PROBLEM SOLVING

Presented by: *William Schwartz* (215)596-9444
University of Pennsylvania

CAMPS was designed to create an authoring system, which allows faculty with no computer skills to develop a simulated patient in a reasonable amount of time. The purposes of these simulations are: to teach problem solving skills including history taking, physical examination interpretation, laboratory testing, treatment and use of consultants in order to make a diagnosis, to sensitize students to the cost of medical assessment, and to develop a profile of students' problem solving skills.

The CAMPS product consists of an authoring system, an extensive series of programs for case creation, data files of normal patients, and monitoring utilities, which allow the faculty to develop scoring standards and read student performance files. Cases are created by substituting case specific items usually 40-50 entries into the normal patient file. Because of extensive subroutines and editing features, a new case can be made in less than one hour. A final score is created from subscores of history, physical, laboratory, treatment, consultations, cost, and diagnosis. The student performance is compared with a panel of experts.

Written in UCSD PASCAL, CAMPS consists of 300K of programs and routines, which are used in case creation and program execution. The authoring system resides in 128K of RAM so that all screens displayed immediately. All items of the perfect patient are kept in a tree structured file and recalled by use of pointers. Each history, physical, and laboratory item is a node in the tree. Use of menus rather than free language also increases the speed of the case execution. The IBM version of CAMPS utilizes the function keys and arrows of the keyboard to allow the computer novice to interact easily with the system. All student choices and diagnoses are maintained in a student file, which can be reviewed by the author for evaluation of the student's performance.

The system is now in use at over 30 medical centers to expose trainees to a variety of clinical problems and to evaluate diagnostic skills. Studies, to date, indicate very good student acceptance, increased scores on standard final examinations, and the ability to detect various profiles of problem solving skills.

MEDCAT/CATS: TWO ARTIFICIAL INTELLIGENCE APPLICATIONS IN MEDICAL EDUCATION

Presented by: *Martin Gardy* (212)472-6939
Cornell University

MEDCAT (Medical Diagnosis, Consultation And Teaching) is an interactive program which makes diagnoses from empiric data stored in patient records, explains its reasoning in response to questions (consultant mode), and uses its logical and communicative skills to instruct medical students in the proper approach to medical diagnosis (student mode). MEDCAT's reasoning can be modified by free format discussions with expert physicians.

CATS (Computerized Anatomical Teaching System) is an entirely separate program designed to teach gross anatomy. Like MEDCAT, it has a "consultant" mode which the student may use to explore the program's reasoning, and a student mode in which the program takes the initiative. A prominent feature of CATS is its ability to discover meaningful general principles which reduce the need for memorization. Gross anatomy is a visual science. For this reason we also have a graphics package for gross anatomy. At CUMC we have largely replaced the textbook with our own illustrated handbook, and students are required to make detailed anatomical drawings. It is this handbook, together with the colored drawings, that is being put on the computer. Students will have the opportunity to use this graphics package before signing onto CATS.

In a sense, internal medicine and gross anatomy represent opposite extremes within the spectrum of medical education. Medical diagnosis (MEDCAT) is heavily dependent on deductive reasoning. Gross anatomy (CATS) is a descriptive discipline which utilizes inductive reasoning to reduce the need for memorization by organizing things into logical groups. Despite these important differences, the data structure and the code are very similar. Both use a powerful natural language interface which parses the input and generates the output. both the knowledge and logic are represented in a three row integer matrix. This is very different from the traditional computer-mediated tutorial approach. There are no pre-stored question or answers. Instead, the program asks and answers questions by evaluating and describing specific parts of its abstract representation of logic. All three programs, MEDCAT, CATS and the graphics package, will be available as demonstrations. Full-time student use will begin September, 1986.

MICROCOMPUTER-BASED MEDICAL EXPERT SYSTEMS

Presented by: *Stan Tuhrim* (301)528-6484
University of Maryland

An expert system is a knowledge-based computer consultant providing problem-solving advice in a given applications domain. The domain presented by this project is that of medicine, specifically, neurology.

Maryland's medical expert systems project is designed to bring expert systems tools into the medical classroom and clinic using IBM PC AT's as a development and implementation base. In general, most medical expert systems have required computing horsepower significantly greater than that afforded by microcomputers. This project has been designed to allow powerful knowledge bases and associated inference engines traditionally requiring mainframe resources to be created and used for patient diagnosis and treatment on microcomputers.

While Maryland's project allows physicians to construct knowledge bases in many areas of neurology, this demonstration is of one particular system designed for diagnosing and treating patients with transient ischemic attacks (TIA's), an important and common medical problem. Such patients typically complain of such conditions as transient weakness, loss of speech or loss of vision, due to insufficient flow of blood to the brain. These attacks are generally considered a warning that the patient is at high risk of having a stroke within the next several months.

The TIA expert system asks questions about patients with episodic symptoms, decides whether or not they really are TIA's, and inquires about possible medical conditions that could be causing or imitating TIA's. The system then determines what part of the brain is involved and what additional tests are needed, and makes treatment recommendations.

The TIA system was originally implemented on a large mainframe system in LISP. By using an expert systems generator designed around the constraints of microcomputers and written in C, and by making significant modifications in the knowledge base, it has become possible to develop significant systems such as this on microcomputers. The presentation will describe both the system and the system generator, as well as the issues involved in running large-scale expert systems tools on micros.

DEVELOPMENT OF A COMPUTERIZED PHARMACY PRACTICE SIMULATION

Presented by: *Michael E. Pitterle*
University of Wisconsin
Co-Authors: *Larry E. Boh*, *Larry W. Schultz* and *Joseph B. Wiederholt*
University of Wisconsin, Madison

Recently, the Pharmacy School curriculum has expanded its patient orientated practice experiences to meet the increased professional demands in this field. Through this experiential learning, the student integrates basic scientific knowledge and clinical patient data to assess medication related problems and provide recommendations for the prevention or resolution of these problems. The patient based educational process is not always consistent and efficient because of limited number of patients and types of encounters that are available to the student. Also, the student working with the preceptor is seldom allowed to experience the consequences of the clinical judgement in terms of patient outcome.

To address the deficiencies of patient orientated practice experiences, we developed a microcomputer patient simulation model to improve pharmacy students' clinical problem solving skills. The simulation provides the student with a variety of clinical data bases, similar to those experienced in the practice setting and range from case history, medication history, laboratory data, physician histories, nursing assessment, and patient responses to questions. Using a menu driven program, the student accesses these data bases and is provided with patient findings, and a message indicating the value of this information. After the completion of data collection the student is asked a series of therapeutic questions about the disease state or medication. Next, the student must implement a therapeutic regimen with the case advancing based on the drug therapy chosen. The student collects additional data, answers questions, and implements further therapy as needed until the case is completed. An internal scoring routine is recording their progress through the data gathering, questioning, and implementation sections. These scores are displayed at the end of the case for the student, and are saved for evaluation by the faculty. The simulation is written in micro-MUMPS which allows for the large amount of text handling and data base manipulation. The program is a text handler that will integrate the case data from separate files created via word processing. By using this design the instructors can develop and enter cases without requiring programming knowledge.

USE OF EXPERT SYSTEMS TO TEACH VETERINARY DIAGNOSTIC DECISION MAKING

Presented by: *Ronald D. Smith* (217)333-3290
University Illinois

The focus of this project is to help veterinary professional students develop and maintain the problem-solving skills needed in the practice of veterinary medicine. This is accomplished through the use of microcomputer-based decision-making aids to evaluate actual clinical cases at the individual or herd level. The need for this approach to teaching is a result of the tremendous expansion in the medical database, and the fact that medical knowledge often is not organized in a way that facilitates problem-solving. This project seeks to alter the way in which students use medical knowledge by leading them through the decision-making process one step at a time. Use of computer-aided diagnosis will shift the emphasis of instruction from rote memorization to problem-solving.

We are using two approaches to the problem. The first, which may be referred to as a "management aid", teaches students how to identify medical problems that require attention from patient or herd medical history and physical examination. Two programs have been adapted for class use. "Pigchamp" is an integrated program for collecting, storing, and analyzing records from swine breeding herds. A second management aid uses data on dairy cow feed composition and milk production to identify suboptimal performance in the herd. As with the previous example, raw data is analyzed and reports generated, which help students identify herd problems. Both programs are currently in use.

"Diagnostic aids" pick up where the management aids finish, i.e., they start with a particular medical problem, guide the student through proper history taking, physical and laboratory examinations, and suggest possible causes for the condition. Perhaps most important, these aids teach students to use standard diagnostic protocols and to be thorough. Three diagnostic aids are under construction. The "Bovine Infertility" aid suggests possible causes of suboptimal reproductive performance in beef or dairy cattle. A "Surgical Decision-Making" aid will help students decide whether surgical intervention is required for an animal and, if so, in what form. A "Neurological Diagnosis" aid will guide students through a complete neurological examination of an animal, identify problem areas, and suggest possible causes.

THE GENIZA PROJECT

Presented by: *Mark Cohen* 609-452-5488
Princeton University

The goal of the Geniza Project is to teach students how to edit, translate, and exploit for historical research the documentary manuscripts of the Cairo Geniza. The tools and methods we develop will be applicable to research on similar groups of historical texts, and (at a more general level) to research on any complex textual material. The manuscripts of the Cairo Geniza, now dispersed among libraries the world over, were preserved by lucky accident. In Judaism, papers bearing the name of God cannot be destroyed by human hands, but must be "buried," like the human body. The Jews of medieval Cairo used to "bury" not only sacred papers but also secular letters, court records, payment orders--anything written in Hebrew characters--in a room in their synagogue. Unlike other such depositories, the Cairo Geniza was never emptied and survived the centuries--so that hundreds of thousands of documents were found miraculously preserved by the climate when the room was re-discovered in the 19th century. The 15,000 historical documents are mostly written in Judeo-Arabic (the variant of "Middle" Arabic spoken by Jews), though many are in Hebrew or Aramaic. They present formidable paleographic, linguistic, and historical problems--and provide an unparalleled wealth of detailed first-hand information about daily life in medieval Islamic societies.

We hope eventually to make all the historical documents of the Geniza available in machine-readable form and to develop software and methods for searching, manipulating, and studying them in ways not always possible before computers. This goal first requires tools for entering and displaying the texts. The inflexibility of commercial text editors for Hebrew and Arabic, however, led us to develop our own: an adaptation of Kedit, given the name Kedit/Semitic and developed at the Princeton University Computer Center by Michael Sperberg-McQueen. Using an IBM Enhanced Graphics Adapter to display Hebrew or Arabic characters on the monochrome screen of an IBM XT, Kedit/Semitic exploits the keyboard- redefinition facilities of Kedit to assign Hebrew characters to keyboard positions, move the cursor from right to left, and so on. In further work we will develop data base systems to handle the complex interrelationships of text, paleographic information, textual-critical commentary, linguistic analysis, historical interpretation, and bibliographic references and to permit sophisticated searches for terms, phrases, names, etc. relevant to particular research topics. For the short term, we are examining available PC concordance programs; in the long term, we hope eventually to adapt standard data base software to help us create and search full linguistic or historical analyses of each text. Searches for individual word forms, roots, syntactic locutions, historical figures, semantic fields,

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or historical problems should be possible with the right data base structure. Right now, at this still early stage of the project, we are using the computer mainly to teach editing and translation of texts, and, in the process, some of the basics of the Judeo-Arabic dialect. In the long run, when a large enough data-base of texts has been built up, it will be possible for students to use the computer in their historical research on the economic and social life of medieval Mediterranean Jewish and Islamic society.

A SUMERIAN DICTIONARY OF THE THIRD MILLENNIUM B.C.

Presented by: *David I. Owen* (607) 256-6275
Cornell University

The development of an electronic dictionary of the world's first and oldest written language is a direct response to the need to manage a vast corpus of mostly unpublished or unedited texts written on clay tablets during the third millennium B.C. in what is now Iraq and Syria. These documents, numbering well over one-hundred thousand, contain records of social, economic, legal, historical, literary, religious, and lexical nature and are the major sources for our understanding of the emergence and development of literate civilization in the ancient Near East. Unlike the better known Semitic language of the Babylonians, which now has two encyclopedic dictionaries available, Sumerian has no such tool to open up its vast informational resources to the probing student or scholar.

The decision to develop a computerized dictionary was made in Rome in the late 1970s by Professor Giovanni Pettinato. He was joined shortly thereafter in this endeavor by scholars from three German universities and most recently by this writer from Cornell University. The first computer-generated volume in three parts, totalling over fifteen-hundred pages, was published in November 1985 by the University of Rome and the National Academy of Italy.

By making so many texts available to students and scholars in an on-line machine-readable format, and through the publication of computer-generated, occasional volumes, this project opens up an enormous area for future research. Furthermore, the lessons learned in the development of this computer program will, no doubt, be of use to other scholars at work on similar dictionary or lexical projects.

Our report will survey the technical problems encountered with the development of the computer program, the current organization of the dictionary project, its status and use as the progresses, and the future plans and potentials beyond the initial goals. A demonstration of how the data base is utilized will complete the presentation.

THE FACILITY FOR THE COMPUTER ANALYSIS OF TEXTS

Presented by: *John Abercrombie* (215)898-4917 PORTER@PENNDRLS
University of Pennsylvania

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The ten fold increase in faculty members in the humanities using computers as primary research and teaching tools has presented the need to coordinate more fully computer-assisted research for these first time users. This is being accomplished through the newly announced Facility for Computer Analysis of Texts (FCAT). The facility provides assistance in areas specifically for textual research. A Kurzweil Data Entry Machine, a sophisticated and programmable optical scanner, is used to transfer texts into electronic form. Last year we transferred 10000 pages of material in Coptic, English, French, Greek, German, Hebrew, Spanish and Yiddish. Once the texts are scanned they may be corrected by a battery of computer programs that access various dictionaries before being "downloaded" to the IBM PC. Software programs for textual research written for the IBM PCs or other equipment on campus are available to all faculty and are used to produce standard tools such as concordances/indices, dictionaries and critical texts, parsed text, etc.

Information on FCAT and current research is available through the Facility's Newsletter, the ONLINE NOTES, distributed monthly and at no charge to subscribers over an electronic network, BITNET. FCAT's archive of ancient to modern texts will shortly be available for micro users on a laser compact disk.

SPINNING A WEB OF SCHOLARLY WORK: A SURVEY OF ENGLISH LITERATURE AS ENHANCED BY THE INTERMEDIA SYSTEM

Presented by: *George Landow, Norman Meyrowitz* (401)863-2001
Brown University

Quality educational software for use in higher education, especially for the humanities, is scarce. Little has been developed in terms of a general-purpose model under which a large class of educational software can be created. Toward that end, researchers at IRIS have undertaken the development of the Intermedia system, a model for building educational software that allows an educator to develop appropriate, extensible, high-quality materials without requiring him/her to become a computer programmer. In order to explore the effectiveness of the Intermedia general-purpose software development environment as an educator's tool, faculty in three disparate disciplines -- English literature, plant cell biology, and music theory -- will be developing computer-based educational models for their respective areas. The first of these three Intermedia-enhanced courses, an English literature survey, is being taught this semester.

The Intermedia system is the framework for a collection of generic components with which educators can build sophisticated, multimedia webs of scholarly information, encouraging connectivity, visualization, and complex filtering of information. Within the system, multiple "what-you-see-is-what-you-get" editors operate simultaneously, allowing the creation of text, graphics, music notation, and animation. Intermedia has an underlying "hypertext" structure which provides the functionality to connect blocks of information together, create paths through a corpus of related material, annotate existing texts, and create links that point readers to such things as bibliographic data, the body of the referenced text, critical essays, illustrative diagrams, and videodisk or animated graphics sequences. IRIS' Norman Meyrowitz and George Landow of the Department of English will discuss the philosophy and concepts behind Intermedia, describe the architecture and implementation of the system and examine how it is being used in Landow's Survey of English Literature from 1700 to the Present.

ISOCRATES: ALL OF GREEK LITERATURE ON A CD ROM

Presented by: *Paul D. Kahn* (401)863-2001 PDK@IRIS
Brown University

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The Institute for Research in Information and Scholarship (IRIS) at Brown University is involved in a long-term research project to develop a Scholar's Workstation. As part of this larger project, we are developing the Isocrates, an application for scholars who make use of Classical Greek literature in their research and writing. We recognize that current CD ROM technology makes practical for the first time the local storage of large (over 200 Megabytes) data bases on workstation computers. This project has three major goals, all of which are intended to explore and extend our understanding of workstation computing:

- Demonstrate the use of interactive software for gaining access to a large static data base pressed on a CD ROM.
- Apply the current theories concerning file systems for the CD ROM to a large full-text application.
- Extend the scholarship tools currently available in this area by tightly integrating a menu-based search and display application with a publication-quality document preparation system.

Our application is designed to run on the kind of powerful workstation Brown intends to use as the basis for a campus-wide network of Scholar's Workstation. This workstation will be equipped with a CD ROM player and the IBM 3812 pageprinter. The CD ROM will be created using the Compact Disk File System (CDFS) developed at the MIT Advanced Media Laboratory by Simson Garfinkel under the direction of Professor Walter Bender. This file system is designed to be operating system and machine independent, and takes into account the needs of both the CD ROM and CD DRAW (Direct Read After Write) technologies. It is intended for applications in either the UNIX or DOS environments. The CDFS ROM will appear as a parallel files system to the software on the Workstation.

The application itself consists of a number of pre-existing modules which have been modified to work together as an integrated application. The CD ROM contains the Classical Greek texts prepared and distributed by Thesaurus Linguae Graecae (TLG) of the University of California at Irvine, along with an inverted index of those texts created by software from the Harvard Classics Computer Project. The TLG data consists of approximately 250 Megabytes and represent the complete works of 180

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authors. The index will be approximately 150 Megabytes. The software for searching this text and displaying the results in the original Greek, developed by Professor Gregory Crane of the Harvard Department of the Classics, will reside on the local disk. Any text identified and/or displayed by a search may be copied from the CD ROM into a file on the local disk in a format readable by the Interleaf Workstation Publishing System (WPS). That file can then be opened as a document from the WPS desktop to display both Greek and English text. IRIS has developed screen and printer fonts to support the Greek text. Both the search and display and the document preparation software can be run concurrently on the Workstation, allowing the scholar to move freely between browsing the data base and composing documents.

IRIS: A TOOL FOR LEARNING

Presented by: *Bruce H. Robinson* (206)543-1773
University of Washington

All physical, freshman, and analytical laboratories have the common objective of collecting data (on a chemical system) and graphing the data in such a way that some sort of least square modelling of the data yields useful information about the chemical system being studied.

We have developed a general purpose program, called IRIS, which allows the student to do the sorts of evaluations necessary to organize, and transform data to the form that is most useful for the "theoretical modelling". We are currently using this program in a variety of laboratory courses. We have found that this program has replaced all previously written special applications programs in our chemistry laboratories.

IRIS is spreadsheet-like to some extent. However, the data is organized by variable names. Variables can be vectors (in which case, a list of data is associated with the variable name) or scalars (a single value is associated with the name). Logical operations may then be performed on defined variables to produce new variables. With each new variable name there is associated a single operation and a set of old variables, which act as sources. For example, if X and Z were previously defined, one could define $Y = X + Z$ as Y (a new variable) will be the result of the operation + on the two sources X and Z.

IRIS functions in such a way that the student is relieved of the drudgery of the calculations, but he must ponder the transformations and manipulations necessary to convert the raw data into relationships that can be tested by the least-squares model. It is this feature of the program that we find most interesting: the student actually must consider the model and its relation to the initial data. His efforts are focused exactly where they should be, and the calculation and graphing aspects are handled by IRIS.

INTERACTIVE GRAPHICS IN CAD/CAI IN CHEMICAL ENGINEERING

Presented by: *Daniel R. Lewin* (818)356-3692
California Institute of Technology

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This paper will describe the developments of a new program incorporating interactive graphics techniques into a teaching and research environment at the Department of Chemical Engineering, Technion, Israel, and the experience of transferring this software from main-frame to PC operating systems at Caltech. Examples are given from studies in the fields of stability analysis, non-linear dynamics and control synthesis. These illustrate the scope for interactive graphics as a means of liberating the student or designer from tedious numerical calculations, allowing him instead to concentrate on the application of his perception and creativity to the problem in hand.

The interactive process control synthesis package, ProCoSP, is introduced. This tool features two design domains (Root Locus and frequency domains) and the performance domain (Step response), and illustrates the advantages of interactive programming in process is the educational value of such a tool. By trying to design control for various process transfer functions using the package, a student of linear control theory armed with the theoretical background will strengthen his practical "feel" for the subject and gain insights into the relationships between the eigenvalue, frequency, and time domains.

It was found that the added portability and convenience achieved by opting for a PC operating environment far outweighed the potential disadvantage of reduced computational power compared to main-frame systems.

COMPUTER GRAPHICS FLOW VISUALIZATION FOR UNDERGRADUATE INSTRUCTION

Presented by: *W. L. Olbricht* (607)256-4362
Cornell University

One of the difficulties in teaching fluid dynamics at the undergraduate level is to display the complicated motions that fluids can undergo in a way that exposes the relationship between certain features of motion and the formal mathematical description of fluid flow. In most cases students are presented a text book illustration of the kinematics of the particular flow being studied for a single set of parameters. Few students seem willing to undertake the extensive, tedious arithmetic computations required to produce representations other than those presented in texts or in class.

We have developed an interactive computer graphics program to help introduce basic concepts of fluid motion through flow visualization for certain prototype flows. We consider the general class of linear two- dimensional flows. The user can display the kinematics of any such flow in color animation by specifying the three independent components of the velocity gradient tensor. The menu-driven program displays the fluid streamlines for the chosen kinematics, or the user can "mark" a "piece" of fluid and then observe the real-time motion of the labeled fluid element. By marking several adjacent fluid points, the user can observe how the fluid both rotates and deforms, and the rates of fluid rotation (vorticity) and stretching (pure strain) can be correlated with the exact choice for the velocity gradient tensor.

The program is also capable of showing the motion of rigid particles that are immersed in the flow. The flow can cause the particles to rotate or to take up preferred spatial orientations, depending on the choice of the velocity gradient tensor and the shape of the particle. To show these effects, the algorithm calculates and displays the motion of a general, rigid, axisymmetric particle, such as a prolate spheroid or a thin rod, suspended in a linear two-dimensional flow. The user specifies the shape of a particle and its initial location. The time- dependent motion of the particle is then exhibited in real time. By "marking" several fluid points near the particle, the user can show how the motion of the particle differs from the motion of the surrounding fluid. Furthermore, the residence time of the particle in the flow is displayed and compared to the residence time of labeled fluid elements.

DEVELOPMENT OF AN EXPERT SYSTEM FOR COMPUTER-AIDED INSTRUCTION IN PROCESS CONTROL

Presented by: *Manfred Morari* (818)356-4186
California Institute of Technology

The process of integrating new theoretical developments into course material and computerized courseware is a difficult task. Often, researchers generate programs which are quite suitable for their particular interests but have no hope for use as teaching tools, because they totally ignore the issues of software robustness and user-friendliness. A number of software tools must be use together to generate a problem solution. Therefore, it is necessary for programs to communicate and interact as a package, however loosely.

This suggests a simple approach. Create two versions of each software tool: one for teaching and one for research. Such approaches results in two (conceptually incompatible) software packages for representing the same body of theory. However, it is usually difficult to justify the development of two brands of each software tool especially for research faculty. In this paper, we present an approach to short-cut this dilemma. We propose an expert system as a means for computer-aided instruction and as a convenient abode for the algorithms representing new theoretical developments. Such a system can be designed to adjust to students, researchers, or practical engineers of radically different experiences and needs.

Artificial Intelligence and Expert System terminology is used with abandon in current literature. We explain the very down-to-earth approach to our expert system project. First, we rely heavily on theoretical results; we avoid the popular probabilistic approach often applied in expert systems but which produce results of dubious reliability. Second, we avoid esoteric programming systems to produce our system: C is used for the data structures, algorithms, and input-output of the decision-support code while Fortran continues to figure in the engineering algorithms. Third, we indicate some choices made in connection with simulations and user input-output. All of these choices should help assure acceptable performance on an IBM PC-AT or similar computer system while retaining a viable upgrade path to Unix-based systems.

Researchers must produce their code (in FORTRAN) as before but with added attention to input-output and error handling. Front-ends of such programs are removed and the remaining sub-routines are integrated into the tree structure of the expert system as new tools. We demonstrate that the extensibility of the expert system can be achieved without significant loss of execution speed.

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The real power of the system as a teaching tool is indicated. We emphasize the software's ability to be set for different backgrounds and needs. We also indicate the effort-saving nature of the system as means for quickly introducing new theoretical findings and procedures into courseware.

CHEMCIL: AN INTELLIGENT CHEMICAL STENCIL FOR CALCULATION OF 3D MOLECULAR COORDINATES

Presented by: *Michael B. Bolger*
University of Southern California

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(LEARNING)

Education in Pharmacy at the chemical level involves teaching students to recognize chemical structures and to correlate biological activity with the molecular functional groups found in a given drug. Interactive three-dimensional computer graphics allows one to visualize and quickly grasp the important aspects of stereochemistry and conformational isosterism that exist between synthetic drugs and corresponding endogenous chemicals found in the body.

(PROBLEM)

We have previously developed and reported on software for display, rotation, scaling, and animated motion of molecules up to 350 atoms. These software tools are only as good as the database of 3D-coordinates that are available for display. The problem in the past has been the lack of X-ray crystallographic structures that are available for classroom demonstrations and computer assisted instruction.

(TOOLS)

A new program has been developed which will allow the user to "draw" a molecule on the video display monitor with a mouse-assisted, intelligent "chemical stencil". The molecule is drawn in two dimensions by the user and a connectivity table is generated. When the molecule is finished, a three dimensional model can be calculated by using an extensive set of standard bond angles and bond lengths. When in doubt the program will prompt the user for dihedral angles. This method can be used for any chemical that the instructor can imagine including fused ring structures and molecules which may not even exist yet. Also, this method will allow the instructor to illustrate the steric consequences of chemically unstable geometric conformations and generate stereo isomers which can be displayed and rotated in perspective to illustrate the axis of symmetry.

A PRACTICAL AUTHORING SYSTEM COMBINING COMPUTER-BASED INSTRUCTION WITH A VIDEO DIGITIZER

Presented by: *Mark A. Guenin* (215)596-9444
University of Pennsylvania

Computer-based instruction (CBI) applications requiring high-resolution images have demanded expensive playback devices such as optical disks or videotape recorders. An authoring system was developed to allow visuals to be stored in diskette files and to incorporate these image files into CBI programs.

The authoring system uses a high-resolution graphics display adapter and a video digitizer to place high quality images directly on the computer display. The instructor is able to capture images onto a computer diskette as a binary file, which can be manipulated as any other diskette file. These image files are then retrieved from an interactive lesson using the PILOT programming language. Each image requires approximately 128 Kbytes of memory which can be reduced through data compression techniques to 60 Kbytes for diskette storage. A diskette can therefore hold four or five images in addition to the lesson program and operating system.

This hardware/software combination offers many advantages over existing systems. No special equipment other than the camera and digitizer are needed at the author's station. The author captures an image and is guided through the creation of the shell of a PILOT program into which the image is to be incorporated. Later, the author can tailor the program to provide, for example, clinical correlation, feedback, and examples of normal variants. Computers at the students' stations need only be equipped with the high-resolution graphics adapter.

This capability adds the visual dimension to the traditional CBI program. The strengths of the PILOT programming language lie in the ability to present text and graphs as an interactive dialogue. This authoring system will give the instructor the additional capability of presenting and testing the student in the interpretation of visual material. For example, one lesson requires the student to identify the abnormality on a lateral neck radiograph.

The hardware/software combination has proved to be a practical alternative to the costly display methods used previously. This authoring system provides an effective means of combining visual and text-oriented material in an interactive CBI lesson.

AN INSTRUCTIONAL FACILITY FOR COMPUTER VISION AND IMAGE PROCESSING

Presented by: *Anthony P. Reeves* (607)256-4296
Cornell University

Image processing is concerned with the manipulation of video data, such as a digitized TV image or a photograph; an image is represented in the computer as a very large matrix of brightness values. Typical image processing operations such as noise filtering and geometric warping require a large amount of computation. The results of an image processing operation are usually best perceived by a human when presented on an image display device such as a video monitor. Computer vision is concerned with the extraction of feature information, such as the location and identification of objects, from an image. Initial image preprocessing is usually essential to achieve good results from a computer vision system.

An instructional facility for image processing and computer vision has been developed at Cornell. The facility provides a wide variety of tools for the manipulation and display of image data. The goal of this facility is to provide students with experience in manipulating video imagery so that they better understand the behavior on real image data of image processing and computer vision algorithms. Students are expected to first use the system as a set of canned programs and then to develop an algorithm (program) of their own. At all stages the display of intermediate image results is very important; in some cases, interactive manipulation of the display is also necessary. At the end of the course the students make class presentations of their projects using slides photographed from the display device of the images they have computed.

The system is hosted on an IBM PX-AT running the XENIX operating system and currently, the IBM Professional Graphics Controller is used for image display. The tools consist of over 150 program modules which have been ported from a UNIX based research system. New tools are being developed to simplify the system use. Students' programs can be developed in C, Pascal, FORTRAN or even C-Shell, whichever is most appropriate; program development tools are provided for all cases.

IMAGE LABORATORY

Presented by: *Ferd Maisel* (301)455-2150
University of Maryland

The Image Laboratory project is based on the view that the computer as an instructional tool in the visual arts can accelerate concept instruction considerably, allowing more possibilities of form and design to be explored in the given semester time-frame. The basic goals of the Image Laboratory project are to integrate the computer into instruction of animation techniques, graphic design issues, and video production. As the visual arts program is designed to teach the concepts and exploratory attitudes that underlie creative expression, we found that using the computer as a teaching tool creates an environment that is conducive not only to exploration, but also to interdisciplinary learning experiences, which would not be possible with traditional tools of the classroom. This new tool/medium does not take the place of existing ones but adds to the concept-instruction tool kit of the visual arts instructor.

In pursuit of our educational computing goals, we sought to create interactive software modules for use in 1.) graphic design and drawing instruction (computer paint programs), 2.) animation studies (animation/inbetweening programs), 3.) video processing/production labs (image processing software), 4.) 3d design/sculpting issues (solids modeling programs). These modules were designed to act both independent of and interactively with the other modules, creating not only task specific routines-as-tools, but also a general purpose, integrated system-as-tool. The interdisciplinary environment created by the process of program design and development can be viewed as a "spin-off" educational experiences; one through which problem-solving and creative processes of disparate disciplines may be shared.

At the start of the project, programs were implemented on the IBM Color Adapter, where testing of basic human factors issues and algorithym development was done. Higher resolution graphics devices were acquired, as well as video image grabbing and processing technology, which allowed for implementation of our programs with finer quality and extended capabilities. These programs designed and programmed by Visual Arts faculty, staff, and students, are designed to provide accelerated feedback from information input, increasing the amount of time the student has for thorough issue exploration.

GENERALIZED VIDEOTEX LABORATORY

Presented by: *John Bowes* (206)543-7998
University of Washington

Over the past decade, the promise of widespread electronic publishing has strongly interested schools of communication. The prospect of popular, in-home database and interactive service access through such systems as Viewtron, Prestel, Antiope, Keyfax, Compuserve and dozens of others seemed to parallel interest in personal computing. As a potential new mass media form, electronic publishing retains characteristics of individualized communication that traditional print and broadcast media with their "one message for all" cannot approach.

Communications students need both general familiarity and specific practice (as would-be writers, advertisers and information database creators) with new media of this kind. Our purpose was to develop a facility that would allow students to construct menu-driven frame series containing their writing, graphics and logical segmentation efforts. Further, we wished to provide a capability for collecting data on how various frame series were used -- essentially a research instrumentation capability which would allow testing and experimentation on sample consumers of this new media form.

The system created is based in the North American Presentation Level Protocol Standard, or NAPLPS, which, since its adoption by AT&T and earlier standardization in Canada as Telidon, has become a de facto standard for North America. NAPLPS, briefly, is a system of compressing simple graphics, color and text for interactive home display over telephone lines and standard television receivers (or adapted personal computers). Its inherent strengths and limitations are boundaries of a novel media form.

Presently our system consists of an AT&T FCS500 frame generator to create frame graphics and text for distribution to a LAN of IBM/PCs. Since this past summer, we have acquired or have developed software to (a) interconnect hardware devices (FCTCOMXY), (b) manipulate frames in a random access manner under program control (RUNVTX), and (c) converts the IBM-PC into a NAPLPS display terminal (PC-Videotex).

Presently, we are planning several instructional and research projects on this facility, including comparison of advertising formats, bulletin writing styles and ease of database use, given varying depths of database logic and selection choices presented. When fully developed, the system offers additionally a generalized CAI capability which may be of use in many courses.

SCRIPTWRITER - INTEGRATED SOFTWARE DEVELOPMENT ENVIRONMENT FOR CAI

Presented by: *Ellis Horowitz*
University of Southern California

SCriptWriter is a software development environment designed especially for the creation of educational software. Its major components include:

- a graphics editor, comparable to PC-Paintbrush and MacPaint;
- a font editor, for remapping the keyboard to special character sets;
- a text editor, emacs-like in style with IBM-PC keyboard special features;
- an animation editor, for creating moving objects during a session;
- a programming language, for coordinating action on the screen.

All components are united within a single metaphor, the notion that an author is creating a play. The author designs his players, their image and their lines. He can rehearse his cast at any time. The metaphor works well in two ways, it serves to simplify complex productions and it makes the job of creating the software fun.

In this talk I will focus on the programming language component of SCriptWriter, called IQ. Of primary interest are a set of special facilities for:

- causing text and pictures to appear on the screen,
- causing a player to move, shrink, expand or rotate,
- causing several players to have coordinated actions,
- analyzing viewer responses,
- and for defining simple natural language dialogues between the program and the viewer.

Moreover there is a tight coupling between objects created in the environment and those defined in the language. The collective value of all of these facilities is that creating educational software in SCriptWriter requires much less code than using conventional programming techniques.

ASSESSING EDUCATION OUTCOMES OF MICROCOMPUTER PROJECTS IN INSTRUCTION AND RESEARCH

Chairperson: *Wayne Danielson*, Project QUEST
University of Texas — Austin
Panelists: *Dick Wilson*
University of Illinois at Urbana-Champaign
Helmut Golde, Project OLYMPUS
University of Washington

This panel will assess the educational impact of microcomputer projects in general terms. Approaches will include evaluating evidence of student achievement, assessing financial and administrative impacts, and developing qualitative approaches to evaluation. The panelists are closely associated with AEP projects in their respective universities.

COMPUTER ASSISTED INSTRUCTION IN NEUROANATOMY

Presented by: *Steven E. Brauth* (301)454-6375
University of Maryland

PROJECT SUMMARY

Human neuroanatomy is a prominent part of many undergraduate and graduate courses in biopsychology including introductory psychology, biological basis of behavior, physiological psychology, human biopsychology, advanced psychophysiology, psychopharmacology and developmental biopsychology. A major difficulty experienced by students of neuroscience involves developing a grasp of the spatial relationships between brain structures, fiber tracts and functional regions. In order to facilitate learning this material, we have developed software utilizing the graphics and text features of the IBM AT computer equipped with advanced graphics capabilities. Three kinds of programs have been developed or are being developed. These form a set of interrelated tools available to students in the above mentioned courses.

PHYSIOLOGICAL SIMULATIONS IN STUDENT LABORATORIES

Presented by: *Robert I. Macey* (415)642-4146
University of California, Berkeley

Physiology, as typically taught in lecture, takes up each organ separately: it describes processes that take place and lists the factors which influence each process. The better instructors make attempts at integrating organ systems, but the number of variables is enormous, the task is formidable and the student is left with long lists of factors which he commits to memory. Rarely, if ever, do students come away with a sense of proportion--what variables are important, which are trivial, and for what process, and by how much? They are neither encouraged nor do they have the means to form their own hypotheses and test the consequences. Although laboratory exercises provide direct experience, they are of no help in this context. Experimental manipulation of living animals requires sophisticated techniques and is rarely directed at exploring more than one or two variables. The student has neither the experience nor the time to carry out any satisfactory laboratory investigation and even the best planned exercises frequently fail. All too often, students leave the lab in disappointment; their frustration is apparent in attitudes of arrogance ("the experiments don't work--they are good") or despair ("the experiments don't work for me--I'm no good').

Our project is directed toward the deficiencies described above. In addition to teaching didactic physiology, we are particularly interested in developing a student's perspective, intuition, and confidence in his ability to learn by doing rather than as a passive listener or reader. We have developed programs to simulate nerve axon action potentials and cardiovascular pressure pulses which make extensive use of high resolution enhanced color graphics; others are under development. Most of the computer output is in the form of traces which plot physiological variables against time. However, action potential programs also have some animation. Typically, a student is presented with a normal trace on the monitor, together with an "abnormal" problem trace obtained by random perturbation of one of the physiological parameters that determine the response. The student is asked to guess which parameter changed and the magnitude of the change. He is then shown the results (a trace) of his guess and can compare it to the normal and the problem traces. Discussions of the actual model and its shortcomings as well as the basis for educated guesses are encouraged.

EVALUATION OF A BAYESIAN FORECASTING MICROCOMPUTER PROGRAM FOR THEOPHYLLINE THERAPY IN PREMATURE INFANTS

Presented by: *Paul J. Godley*
University of Texas, Austin

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DESCRIPTION : Theophylline is a respiratory stimulant that is used in premature infants for the treatment of apnea. Although the efficacy of theophylline 1-8 has been well established, the optimal nontoxic dose is difficult to predict for each individual infant. Either exceeding or not achieving optimal therapeutic serum concentrations of this drug may have life threatening consequences for a neonate. We are developing a microcomputer program for the IBM PC-XT that uses an iterative Bayesian regression formula to estimate pharmacokinetic parameters for theophylline and to predict subsequent theophylline serum concentrations. We would like to evaluate the predictive performance of this program for theophylline dosing and its effects on the quality of care in a neonatal population. Additional research that will evolve from the pharmacokinetic parameters generated by this program will be used to develop population parameter estimates for theophylline in newborns. These estimates can be used to modify initial Bayesian estimates, which theoretically should improve the predictive performance of this method, and therefore the quality of care. This program will also be compared to least squares exponential regression, which has been used for predicting neonatal theophylline serum concentrations.

COMPUTER-ASSISTED INSTRUCTION IN PHILOSOPHY

Presented by: *Steven Bend* (412)268-8490 TE.CC.CMU.EDU
Carnegie Mellon University

Formal, symbolic logic is an orderly, precise discipline and well suited to the computer environment. So, it's no surprise that the computer has been utilized to help teachers to teach--and students to learn--symbolic logic. Symbolic logic looks much like mathematics to many students. In fact, one of it's principal functions is as a language in which to formulate mathematical theory. Symbolic logic is an 'artificial' language, but one capable of teaching us some important things about our natural language and the arguments we express in it. The computer can be especially helpful giving students practice in translating natural language and natural language arguments into the more precise language of symbolic logic, in which they then learn to analyze logic problems and test for important formal properties like consistency/inconsistency, contradiction, validity/invalidity.

Preston Covey has developed a package of computer-assisted instruction programs to teach formal, symbolic logic and its applications to problems and arguments in natural language. These programs currently exist both on mainframes and microcomputers. I am serving as project manager and principal designer of new microcomputer versions of these programs for publication by McGraw-Hill in the fall of 1986. Our team is also working on versions of these programs for the advanced workstations running the Andrew system at Carnegie Mellon. There are three main programs in the McGraw-Hill package. The SYMBOL and TRUTH programs generate problems in symbolization and logical analysis. These programs make up problems to which they know the answers. Hence, they will never run out of problems; the teacher does not have to create or correct homework sets, and the students don't have to wait for corrective feedback and can get as much practice as they need or want whenever they want. The student selects the type, complexity and level of difficulty she wants from a menu of options; or she can instruct the program to create problems to her own specifications. The ARGUE program provides the user with an environment for solving problems in proof construction and derivation using symbolic notation. These formal derivations provide a heuristic framework for more substantive tasks in logical analysis and philosophic inquiry: demonstrating properties of arguments like validity or inconsistency; finding 'missing' premises in arguments; formulating the 'underlying' normative principles of philosophic positions on ethical or policy issues; and testing the plausibility of general principles against their logical consequences, counter-examples or limiting cases. The programs check each step of a student's logical derivation, thus obviating the possibility of a student proceeding on a misunderstanding unawares. The program's problem sets present argument texts in English or logical

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word problems for analysis; and they allow students to enter problems with English assignments to the logical variables. Consequently, they can give English translations of the symbolic formulae the student is manipulating and allow the student to examine both the logical form and the English content of the problem every step of the way.

LOGIC: A WORKBOOK

Presented by: *Robert L. Martin* (213)825-4641
University of California, Los Angeles
Coauthors: *David Kaplan*
University of California, Los Angeles

Our goal is to develop powerful but essentially unobtrusive software for a course, which we consider excellent and effective already. We experimented with an existing software package, which replaces classroom teaching entirely; we found it impressive but definitely obtrusive. Our program is designed to allow students to do their homework at the computer; to provide them with instant correction and explanation and to provide professor and TA's with printouts of computer-corrected assignments and records of student practice and progress that can be used in grading. The program, which is key to Kalish, Montague, and Mar text used for Logic, A First Course, supports work on four kinds of problems: 1.) recognizing and parsing symbolic formulas; 2.) symbolizing; 3.) applying rules of inference; 4.) formal derivations. Context-sensitive Help, Reference materials, and other features are available at all times. For the Winter Quarter of 1986, the program is being used by approximately 160 students using networked IBM PC-XT's in the Social Science Computing Laboratory.

Our program is written in C. It incorporates the C-Index package, which supports a database of problems and students' work. the user-interface is menu-oriented and makes extensive use of function keys. Full-screen editing is provided for the derivations. Care was taken to assure a uniform control structure, which allows the user quickly to gain proficiency in the use of the program. The proof-checker component uses the LEX and YACC C-code generators and incorporates Lisp-like techniques.

PHILOSOPHICAL SIMULATIONS AND EXPERIMENTS

Presented by: *Robert L. Causey*
University of Texas, Austin

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DESCRIPTION: Standard computer simulations model possible real-world systems. This project is innovative as an application of the computer to abstract, philosophical problem situations. The following description shows how we plan to begin; experience should lead to additional philosophical uses of the equipment.

Scientific Theory Construction and Testing - Inductive reasoning, hypothesis formation, and methods of theory testing are major topics in the philosophy of science. Yet, many students lack serious experience with these activities. We can repeatedly display a matrix of squares on a CRT and have these squares painted sequentially with different colors, chosen at random for each small square in the matrix. We can program "laws" which partially override the random paintings, imposing relationships between the colors of certain squares. The student user hypothesizes these laws by observing the color patterns and inductive reasoning. In order to test hypotheses about the hidden laws the user specifies the colors of particular squares before the laws actuate and the display occurs. We can program different sets of laws to construct many "color worlds" exhibiting important aspects of theory construction and testing. Other, related programs can be written, e.g., we can let the student compose the laws and experiment with the worlds he creates; we might create a different kinds of program to experiment with functional explanations of systems with interdependent parts. The use of abstract graphics patterns will focus on logical and methodological aspects of theory structure and testing.

COMPUTER-AIDED DESIGN OF MICROWAVE INTEGRATED CIRCUITS

Presented by: *David Rutledge*, (818)356-4806
California Institute of Technology
Coauthors: *Wyman Williams*,
Richard Compton
California Institute of Technology

Caltech has a one-quarter class in computer-aided design of microwave integrated circuits for seniors and graduate students. The class includes two lectures and a three-hour lab each week. The students make a variety of microstrip circuits and devices including a branch-line coupler, matching networks, a patch antenna, a mixer, and a low-noise amplifier. The students design the microwave circuits on the computer and make the photographic artwork on a dot-matrix printer. Then, they photographically reduce the dot-matrix printer output onto a glass plate and use the glass plate to etch the microstrip circuit. The circuits are tested with a network analyzer controlled by an IBM PC.

Microwave circuit design is particularly attractive on a personal computer. Typically, a network solution requires that a sparse complex matrix of order twenty or less be at about fifty different frequencies. This requires a few seconds on an AT and is quite convenient for making quick design changes. We have written a Turbo Pascal program, Puff, which simulates microwave circuits and makes the artwork.

A personal computer is also particularly helpful in microwave measurements. This is because a large number of calibrations and corrections with complex numbers are needed. We have written another Turbo Pascal program, Elf, that helps the students make scattering parameter measurements.

COMPUTER-AIDED SYSTEM ANALYSIS AND DESIGN

Presented by: *Bradley W. Dickinson* 609-452-4644
Princeton University

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Dynamic systems, modeled by sets of differential equations, are commonly introduced to electrical engineering students after basic courses in circuits and electronics. The traditional academic emphasis on closed form analytical methods does not provide any familiarity with the computer-aided analysis and design methods prevalent in engineering practice. The goal of the project is to develop an introductory systems course, at the junior level, which concentrates on issues that are fundamental to computer-aided techniques for dynamic systems. Topics include: linear algebra and matrix theory applied to systems; qualitative behavior of nonlinear systems; parameter optimization, optimal control, and dynamic programming.

For the most part, the computational exercises to accompany the course material have been designed around the PC-MATLAB package of reliable numerical linear algebra software which provides access to these routines through an easy to use syntax. PC-MATLAB includes many graphics display functions; others have been written to support color graphics and pen plotting. With this software, students have been able to carry out system analysis and design projects that would have been far too complicated and time consuming to do "by hand" or even by writing specific numerical analysis programs, say in FORTRAN. As a result, the efforts devoted by students to the projects have been focused on mastering the dynamic systems material rather than on programming details.

A PC-BASED VLSI DESIGN SYSTEM FOR EDUCATION

Presented by: *Mani Soma* (206)545-3810
University of Washington

A VLSI design system has been installed on IBM PC-ATs for teaching graduate and undergraduate courses in integrated circuit design at the University of Washington. Such a system traditionally resides on a main-frame computer (such as VAXes) and more recently has been transported to workstations (such as Mentor, Valid, etc.). Despite the availability of design software supplied by universities at minimal cost, the main-frame computer or the workstations are reasonably expensive and cannot accommodate a large number of users of students in classes. For example, our design courses in the past 3 years on a VAX 11/780 handled only 15 students per quarter. With the improvement of hardware and software on the IBM PC-AT, we have recently made a concerted effort to transport the design system onto the PC-ATs supplied by the Olympus program. At the time of this writing (January 1986), the layout tools, which form the largest subset of the design software, have been successfully installed on the AT. These tools enable a student to layout basic gates or cells, logic blocks such as PLAs and registers, and build up to large-scale systems. The current limit, imposed by available memory and disk space on the AT, is 50,000 devices per design. The tools also permit layout inspections, layout corrections, and can be easily used for full-custom and/or standard-cell designs. Since each PC is a single-user system, the performance of these tools exceeds that of VAX 11/780 in the time-sharing mode (more than 4 users doing layout).

The simulation and layout verifications tools are accessible from the PC via BITNET for large designs and are being modified for PC installation. It should be noted that on the commercial market, a more limited system (capable of standard-cell design but not full-custom) recently became available and is priced higher than $50,000 per station. From the educational perspective, our PC system not only is more cost-effective but also vastly augments our capacity to handle design courses. Beginning with the 1986 academic year, the system accommodates up to 50 students per course using 4 PC-ATs with Professional Graphics Monitor. After further checks of this design system, we plan to make it available for use at other universities.

LABORATORIES FOR INTRODUCTORY PSYCHOLOGY

Presented by: *David R. Williams* (215)898-6947 PORTER@PENNDRLS
University of Pennsylvania

The substance of Introductory Psychology at the College level is experimental in origin: it places ordinary phenomena of mind and behavior in an unfamiliar paradigm and explores them in a manner that is highly analytic and foreign to the thinking of most students. Laboratories illustrating the way psychologists investigate their phenomena have traditionally provided the best remedy to the pedagogical challenge: one experience is worth hours of lecture. Traditionally, however, Laboratories have been difficult to implement, because students lack experimental skills. The PC, with its graphics display and interactional capabilities, provides an admirable way around this difficulty. We have brought some of the Skinnerian principles of programmed instruction to bear on the problem, and have developed a series of Laboratory programs that introduce students to principles of behavior analysis and to the experimental study of perception. The Laboratories mix textual and experimental components in an informative progression that is self-paced and responsive to the initiative of the student. Outside supervision and explanation are not required.

The presentation will stress the Behavior Analysis Laboratory, which introduces students to quantitative methods by developing a model of the factors that might plausibly control freshman studying behavior. The pressure of exams, random distracting influences, and social life are quantitatively described in terms of reinforcement theory, and combined according to experimentally-determined behavioral laws. An opponent-process theory of motivation is introduced. Students manipulate the components of the model and its parameters of reinforcement magnitude and probability, and observe the effects of these as well as attitude variables on studying behavior. A Perception Laboratory, which permits students to explore the Muller-Lyer illusion, will also be discussed. Both Laboratories involve text and graphics techniques, coordinate visual and auditory feedback, and require only joystick control of options. The text displays encourage individual experimentation with the material, through direct suggestions and hint screens. Programs and textual material are downloaded to the experimental stations from a central file server. The techniques we have developed are easily adapted to many other Laboratory projects; the presentation mix will favor educational aspects, but technical features of the Laboratories will be described as well, and on the whole they are succeeding in attaining their goal.

COMPUTER BASED INSTRUCTIONAL MATERIALS IN COUNSELING PSYCHOLOGY

Presented by: *James L. Lee* (608)262-8893
University of Wisconsin, Madison

The department offers primarily a graduate studies program for masters and doctoral students but does teach several undergraduate courses focused on self-development as a student/person. Our AEP project is focused on four areas:

1.) Software which can be used to promote self-exploration and development among lower level undergraduate students enrolled in one credit modules to enhance: personal development, study skills, and career exploration. Ideally, we would use standardized inventories in this process accompanied by individual and small group interaction. The costs and commercial scoring time lags make this prohibitive. We have developed a three disk series, each containing four self-exploration inventories which allow students to examine various aspects of self around the three topical areas of the courses.

2.) A major issue in our field precipitated by declining social service budgets is counseling effectiveness and accountability. Two specialized data based systems have been developed to help our counseling practicum and internship students account for their utilization of agency resources and to assess their counseling effectiveness.

3.) The micro-computer allows us to investigate more efficient and cost effective ways of direct client service delivery. We are examining ways of using the computer to deliver counseling services. In this regard, we have developed a weight loss/eating habits computer enhanced training program, which includes the use of subliminal suggestion.

4.) The last area of focus is presently under development. A great deal of counselor training revolves around learning to discriminate and respond appropriately to client statements, statements which are usually called linguistically ill-formed. We are developing response skill training software, which will eventually be combined with video cassette or disc.

MICROCOMPUTERS AND THE SPEED OF THOUGHT: A COGNITIVE TESTING STATION FOR MEASURING AND ALTERING RAPID COGNITIVE PROCESSES

Presented by: *Kevin F. Miller*
University of Texas, Austin

DESCRIPTION: As part of a project to investigate the development of rapid cognitive processes, we will develop a computerized cognitive testing station capable of accurately timing performance of tasks such as simple addition (e.g., seeing "3 + 7" and saying "10") and providing subjects with feedback about the accuracy and speed of their performance. The cognitive testing station will be built around an IBM PC-AT and a trainable speech recognition board. Experimental control software will be developed which will permit ready modification for use in a variety of cognitive experiments. The system will be designed to present subjects with feedback on the speed of responding (relative to prior trials) to permit research on the use of microcomputers in developing skill at basic cognitive tasks.

Our educational objectives are threefold. 1) By developing standard experimental software it will now be possible for students enrolled in practicum courses to develop their own experiments to an extent not previously possible. 2) This system will be used in courses in psychological methods to provide demonstrations of the use of chronometric methods to develop models for the performance of rapid cognitive processes. 3) Finally, the system itself is instructional in nature. It will be used to explore the development of high levels of skill in children and adults at performing basic cognitive tasks, and the consequences of such skill.

TUTORIAL: PSYCHOLOGICAL PRINCIPLES UNDERLYING THE DESIGN OF COMPUTER-BASED INSTRUCTION

Chairperson: *Geri Gay*,
Cornell University
Panelists: *Sharon Dugdale*,
University of Illinois
Bruce Sherwood,
Carnegie-Mellon University
Ruth Chabay,
Stanford University

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During the past twenty-five years, a growing knowledge base about the theories and models of computer-based instruction has emerged. Computer-based courseware can best be built on information about the student's level of knowledge, how he or she interacts with the machine, theory and principles involved in learning. Yet, courseware designers continue to neglect the psychological and educational principles that govern learning and teaching.

The purpose of this session is to examine current learning theories and models of instruction as they apply to computer-based instructional design. Different models and theories are designed to produce different outcomes under different conditions (for different types of content, learner characteristics, and constraints). The discussion will emphasize some of the factors which influence learning and instruction from all three theoretical perspectives: behavioral, cognitive, and humanistic. The speakers will suggest ways of improving designs of computer-based learning programs by examining state-of-the-art examples, identifying key factors which influence learning, and identifying different ways students are likely to be influenced by these theories. Topics covered in this session include the functions of feedback, structure and organizing frameworks, learner control, fantasy and curiosity, motivation, and cognitive processes.

TUTORIAL: IS CONVERGENCE ON A WINDOW MANAGER/ENVIRONMENT STANDARD POSSIBLE?

Andries Van Dam (401)863-2001
Brown University
Coauthor: *Michael J. Braca*
Brown University

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One of the primary goals of the academic workstation software researchers at Brown University, Carnegie-Mellon University, and the Massachusetts Institute of Technology is the sharing of scholarly tools developed at each site. Only through agreements on a common application Program Interface (API) and User Interface (UI) can such a goal be realized. In March of 1986, representatives from the three universities will participate in a workshop to discuss how to overcome present impediments to such a convergence and, if deemed appropriate, to define a standard to which developed educational software and research tools should adhere.

One obstacle to convergence is deciding at what level to standardize. Virtually no one believes that total agreement can be reached in the short term on the visual and interactive aspects of the UI. More likely, the effort will concentrate on the defining an API able to support with reasonable performance the styles of interface being proposed at each of the participating sites.

The issues raised and conclusions reached at the workshop will be presented by Professor van Dam, the workshop leader, and Mr. Braca, leader of the Brown delegation to the workshop.

TOOLS FOR LEARNING DATA ANALYSIS

Presented by: *Eugene Kroch* (215)898-1875 PORTER@PENNDRLS
University of Pennsylvania

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Students are often confused by the abstractions of statistics textbooks. Even when a text provides concrete examples, students still may not develop the ability to apply the methodology to new circumstances. The microcomputer is a means to experiment with statistical techniques and data sets in order to help students develop an operational knowledge of methodology. The computer can free students from the tedium of hand calculations and provide them with a guide to the application of techniques. Still, the challenge of learning statistical analysis is to understand the distinction between data description and inference. That challenge is the focus of our efforts at the Undergraduate Data Analysis Laboratory at Penn.

Using APL and a network of IBM PCs, we have been able to create an extremely friendly interactive environment where students are guided through the application of statistical techniques introduced in classroom lectures. The system is fully menu driven and organized to be compatible with the textbook and the pace of the lectures. In the section on data description students work examples using exploratory data analysis: stem and leaf plots, boxplots, smoothing, robust fitting, and other methods, all using APL's graphics features. They are then asked to choose two or three of their own applications from data sets and techniques provided. A workbook accompanies all exercises, asking questions and providing feedback. In the section on inferential techniques, students explore the properties of estimators and testing procedures. They run a series of Monte Carlo experiments designed to demonstrate how these inferential methods differ from data description techniques. Results of simulations are displayed graphically. Again, students can control the environment and choose applications from a menu of options. In the final phase, students specify, estimate, and simulate a multi-equation model. An accompanying set of exercises help the student to explore its dynamic properties.

LINPRO: A SOFTWARE PACKAGE FOR AID IN TEACHING THE RUDIMENTS OF LINEAR PROGRAMMING

Presented by: *E. Andrew Boyd* (617)253-3613
Massachusetts Institute of Technology

LINPRO is an educational software package that unifies the analytic and geometric aspects of linear programming. LINPRO displays both a simplex tableau and a graphical representation of a linear program. Students take advantage of the geometric and algebraic assistance of the package to explore the operation of the simplex algorithm. As they experiment with the basic steps of the simplex algorithm, students are encouraged to ask questions. What happens if the minimum-ratio test is ignored? How does the optimal solution change when cost coefficients vary? What is the geometric interpretation of degeneracy? of multiple optimal solutions? of an unbounded linear program? LINPRO does not solve linear programs to optimality, but instead provides the tools with which to answer these and other questions.

Experience to date suggests that LINPRO is an invaluable pedagogical tool that is quite different from typical linear programming packages. Since LINPRO focuses upon concept emphasis rather than solving real problems, it actually serves to complement many linear programming packages already used in education.

LINPRO is coded in C and makes use of the Graphic Kernal System (GKS) and the Virtual Device Interface (VDI). LINPRO will function on all IBM Personal Computers capable of graphics, although it was designed to exploit the capabilities of an IBM AT equipped with a Professional Graphics Display. The development of LINPRO uncovered many of the strengths and weaknesses of IBM's most advanced personal computer and its supporting software.

ENHANCING THE ANALYTIC COMPONENT OF QUANTITATIVE METHODS

Presented by: *Susan G. Hadden*
University of Texas, Austin

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DESCRIPTION: Each of the more than 90 students entering the LBJ School every year is required to take certain core courses, among which are a first semester course in operations research and a second semester course in statistics. Most students have been trained in the liberal arts as undergraduates and have little background in mathematics. Not only does this create difficulties in designing appropriate graduate level courses, but it also limits the student's abilities to understand the relevance of the material (especially that in the first semester) to their immediate professional concern with policy making. The purpose of the proposed project is to adapt existing software and, where necessary, design new computer software that will become an integral part of the courses and will fulfill three purposes:

1.) Make it possible to emphasize managerial decision making rather than mechanical algebraic skills in the course,

2.) Enable the instructors to tailor the materials to clusters of students with different levels of mathematical preparation (it will be easier for students to work individually at their own pace, for example),

3.) Lend students a concrete appreciation for the utility of computers in public policy.

The unusual feature of the courses as they will be taught with microcomputers is that they will allow students to achieve an understanding of the formal tools of management science that are normally available only to those with much stronger preparations in mathematics. By making it possible to display linear programming and other classical problems with color graphics, students can obtain insights that no textbook or blackboard can offer. The computer also relieves students of the need to follow tedious computations (finding matrix inverses, pivoting on a simplex tableau, etc.) and thereby frees them to concentrate on problem formulation and on ways in which these tools can be applied. It also frees them to think in terms of sensitivity analysis - exploring the degree to which solutions are sensitive to perturbations - instead of believing that problems have unique solutions.

MICROCOMPUTER SYSTEM FOR VEHICLE ROUTING

Presented by: *Lawrence Bodin* (301)454-3471
University of Maryland

This project assists students in the solution of network optimization and vehicle routing and scheduling problems. These problems are among those most frequently encountered in the teaching of operations research. Problems modeled range from simple distance minimization to more complex multivariate minimizations in which distance is only one of several variables to be optimized. The applications domains of this system include transportation, chip design, communications network design, manpower scheduling, and facility location.

This routing system is based on theoretical work and on algorithms developed by Maryland faculty over the past several years. The goal of this project is to take serious faculty research tools and techniques and to bring them into the classroom, developing student problem solving techniques and student intuition using complex problems and rich simulation tools.

The approach to the representation and solution of routing problems taken by this project is to emphasize graphics and ongoing interaction between student and machine. The system provides students with tools for graphically displaying networks (2D and 3D graphics), for computing distances, and for displaying the optimization status of each variable under analysis.

Nevertheless, despite the tools provided, it is the student, not the computer, who generates solutions to these network optimization problems. Students may step through solutions, viewing networks over time. As they alter, change, or destroy solutions, students receive immediate feedback, and may compare current solution with results of previous efforts.

The goal, therefore, of this software is to provide students with an environment of rich tools for learning how to solve complex optimization problems, rather than with a black box that solves problems for students. Thus, in addition to discussing the network optimization software itself, the presentation will focus on issues relating to how the computer can enhance the student's abilities in complex problem solving.

SAMP - A PROGRAM TO COMPUTE SAMPLE SIZE

Presented by: *Peter A. Lachenbruch* (213)825-5250
University of California, Los Angeles

An important aspect in designing experimental studies is planning the analysis, which in turn leads to questions of how many observations should be obtained. This problem must be faced by all investigators and is often the problem which brings the researcher to the statistician's office.

The assumptions which enter into the computations are often found to lead to sample size which are practically unattainable. Thus, it is often useful to recompute the sample size requirements several times using different assumptions. The elementary statistics student can also experiment with different assumptions to explore their different effects. Unfortunately, most of us lose interest after computing the sample size two or three times.

The mathematics of sample size are straight forward for many experimental designs and are easily mastered by students in their first courses of statistics. However, they are often just as easily forgotten. The program, SAMP, allows the user to compute sample sizes for a wide variety of one and two sample models (the most common ones) and to easily modify assumptions and redo the computations. The program automatically produces three sample size which depend on different alternative hypotheses. The models include:

Binomial:	Normal:	Non-parametric:
One Sample	One Sample	Sign test
Two Sample	Two Sample	Wilcoxon-Mann-Whitney
Matched pairs (McNemar's test)	Matched pairs	Signed rank
Confidence Interval	Confidence Interval	Log-rank test

TEACHING NUMBERICAL MATHEMATICS USING INTERACTIVE COMPUTER GRAPHICS

Presented by: *George F. Pinder* (609)452-4602 G1052@PUCC
Princeton University

Numerical methods, an essential element of modern engineering education, is not easily taught at the undergraduate level. In its elementary form this important topic appears abstract and its relationship to real world applications opaque. Our approach to overcoming these problems was to first subdivide the subject into five separate teaching segments: polynomial approximation theory, numerical integration, numerical differentiation, ordinary differential equations and partial differential equations. A software package was then prepared for each section by undergraduate assistants and research staff. Each package was interactive on the IBM PC-XT/370 system. Enrollments in this elective course, which historically were relatively low, more than tripled since the introduction of the interactive graphics format.

WHICH WAVE THEORY?

Presented by: *Rodney J. Sobey* (415)642-3162
University of California, Berkeley

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In much of the practice of coastal and ocean engineering, the question of which wave theory to use has been largely of academic interest. Linear (Stokes I) wave theory is accessible, familiar, and easy to use. Consideration of shallow water and/or higher order wave theories has been substantially complicated by the relative inaccessibility of these theories. The literature is extensive and confusing, which has often led to the adoption of linear wave theory, whether or not it is appropriate.

Both graduate instruction and professional practice have suffered from this confusion. A paper just completed by Sobey et al. has clarified much of this uncertainty and has resulted in a coordinated presentation of Stokes, Cnoidal, and Fourier wave theory. This study has rationalized the application and microcomputer implementation of alternative wave theories but has identified a more deeply imbedded problem, namely the identification of a valid math solution as a valid physical solution. In much of the practical parameter range, math predictions are available from a range of orders from Stokes, Cnoidal, and Fourier theories. The differences are often considerable. In some cases, physically improbable solutions are quite clear but often the suspicious aspects can be overlooked if only a small part of the solution field is perused.

The choice of which wave theory requires perusal of the complete solution field for all field variables (horizontal and vertical velocity, horizontal and vertical acceleration and pressure) as well as the water surface profile. Computer graphics is the appropriate tool, specifically scalar contour plots of each field variable in a moving reference frame between adjacent wave crests. The proposed paper will show complete field contour plots of field variables from alternative theories, as an aid to confirming or rejecting the physical validity of the math solutions. The complete research was undertaken on a combination of PC's and PC-AT's with standard and enhanced color graphics, Professional Fortran, and the IBM Plotting System.

INTERACTIVE ENVIRONMENTAL MODELING AND GRAPHICAL DISPLAY OF SPATIAL AND TEMPORAL DATA

Presented by: *Daniel P. Loucks* (607)256-4896 PCSJ @ CORNELLA
Cornell University

A group of functions and subroutines are being developed and documented to permit students to incorporate their own models of various environmental systems within an interactive graphics system. Such a system facilitates data input and editing of data needed by the model as well as model operation and display of model results. Many of the models produce data that vary over space and time. Through the use of video-digitized maps and transparent color overlays, users of this interactive system can observe, for example, the extent of a flood over a land area, or the progressive spreading of a plume of groundwater contaminant in an aquifer, while still seeing the ground surface features in the original base map.

Many of the computer programs being developed are to be used to teach students the elements of computer graphics and interactive modeling techniques. Several application programs will permit them to create and edit color coded data on maps, perform map overlays, and display various time series or geographic data. The IBM PC-AT with an additional third-party graphics board permitting the display of up to 256 different colors is being used for program development, and will be used by the students making use of these programs and equipment.

CLOSED LOOP DYNAMIC TEST CONTROL USING AN IBM PC-AT

Presented by: *Jorge Sousa* (415)231-9560
University of California, Berkeley
Coauthors: *C. L. Monismith*
University of California, Berkeley

A research project to determine dynamic properties of pavement materials required the excitation of hollow cylindrical shaped specimens with two independent sinusoidal loads with frequencies up to 40 Hz.

An IBM PC-AT equipped with a Metrabyte DASH 16 data acquisition board was used to directly control two MTS Hydraulic Servorams.

Menu driven software was developed, taking advantage of DMA channels, so that data acquisition, wave form generation, and closed loop control could simultaneously take place at rates over 5000 samples per second per channel. A post processing menu driven program converts ram data in the desired graphs and parameters representative of the dynamic material properties.

Based on the same approach existing laboratory tests, routinely executed as part of class work, were redesigned turning data acquisition, equipment control, and data processing from tedious tasks into stimulating experiments.

COMPUTER AUGMENTATION OF FLIGHT SIMULATOR TRAINING

Presented by: *Christopher Wickens*
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Project objectives are to standardize instruction; incorporate realistic environmental cues (e.g., radio communications and "outside-the-cockpit" visual displays); augment performance feedback; provide part-task training with "freeze" and "replay" features; and automate aspects of student performance monitoring for the flight simulator portion of the Institute of Aviation's introductory flight course. The networking of two ILLInois Micro Aviation Computer (ILLIMAC) digital flight simulators with three IBM PC-AT's provides instructor control and monitoring of both simulators from a single PC-AT. Students in each simulator receive instructions, performance feedback, and supplementary graphic flight profile information from an IBM high resolution color display mounted on the simulator.

Two aspects of the project, relating to visual cues for landing and radio communications, are being expanded for part-task training on an IBM PC-AT that is not part of the networked configuration. The graphics capability of the PC-AT is being used to create a real-time display for training students to land an aircraft. Questions being addressed during development include whether a skeletal display of the basic perspective changes in the runway and centerline during approach will provide sufficient perceptual information for the pilot to land. Students will control the position of a simulated aircraft by means of a two-axis joystick and an auditory "warning" tone will be generated upon deviation from the proper glideslope.

For training radio communications skills and airport procedures, a digital audio recorder/playback device will be interfaced with the IBM PC-AT. This device allows for the presentation of sample radio transmissions actually recorded in-flight. The transmissions will be accessed both in tutorial components to train the fundamentals of radio communications and during more interactive units to exercise student communication skills. In the latter, the student will be required to communicate with or respond to instructions from appropriate control facilities as he or she manipulates an

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aircraft through a graphic representation of the ramps, taxiways, and runways of the airport for takeoff; flies out to a practice area; and returns to the airport to land and park the aircraft.

DYNAMIC MODELS IN BIOCHEMISTRY

Presented by: *Sandra I. Lamb* (213)825-1853
University of California, Los Angeles

Biochemistry deals with complex chemical interactions in living cells. For example, the rates of many enzyme-catalyzed reactions are of high kinetic order with respect to substrates (differing in this regard from reactions that students have encountered in other areas of chemistry) and the catalytic properties of the enzymes are modulated in complex ways by the concentrations of other metabolites, which serve as regulatory signals. These properties underlie the interactions between sequences of chemical reactions that maintain homeostasis in living organism. Students find it difficult to develop an understanding of such interactions, which involve several variable inputs from descriptions in textbooks or lectures, and the relationships are not easily illustrated in the time available for metabolism in undergraduate laboratory courses.

Commercial spreadsheet programs are ideal for modeling interactions of this kind. The structure of the model is clearly visible to the student, and the models can be designed to allow a wide variety of "what if" questions--both simulations of experiments that in principle might be run in the laboratory if unlimited time and resources were available and imaginary variations in the properties of enzymes to gain an intuitive feeling for their evolutionary design. Spreadsheet models are equally suitable in other areas of interest in Biochemistry and Molecular Biology, such as movements of materials across biological membranes and conformations of macromolecules.

We have developed a series of such models dealing with topics ranging from very simple theromodynamic and kinetic principles to complex metabolic interactions, membrane behavior, and macromolecular properties. These models can be implemented on any spreadsheet program that includes logarithmic functions. They are set up for keyboard entry by the student (rather than for loading from pre-recorded diskettes) in order to encourage students to interact actively with the models and to lead interested students to design their own models to explore other relationships. To further that goal, a number of suggestions for student modification of the programs or for design of related programs are included.

A few of the models have had limited testing at several schools. The set as a whole is ready for its first full-scale exposure to students at UCLA this quarter.

CELL HOMEOSTASIS

Presented by: *Eric Jakobsson* (217)333-3918
University of Illinois

The water and solute concentrations of living cells are determined by the combined effects of many transport processes across the surface membranes and many intracellular reactions. The simulation around which this lesson is built contains dynamic models of many of the most important of these processes. Among the processes included are electrodiffusion of sodium, potassium, chloride, and calcium ions; metabolically driven transport of sodium, potassium, and calcium ions; exchange diffusion of sodium and calcium ions; and intracellular calcium buffering. The inputs that can be specified by the user include parameters of the transport processes and intracellular buffers, and the composition of the cell bathing medium. The output is the dynamic response and ultimate steady state following a change in any of the input parameters. For the researcher, the model provides insight into the functional interactions of various cell processes. When combined with the interactive text being developed for instructional purposes, the model permits the student to simulate particular experiments that demonstrate important effects. These include cell swelling when the sodium-potassium pump is shut down or when the membrane is depolarized, as for example by an increase in extracellular potassium. On the other hand, a slight reduction in pump activity has as its main effect an increase in intracellular calcium, which is the basis for increasing cardiac contractility by the drug digitalis. A comprehensive dynamic computer model is a valuable tool in understanding and teaching about such nonlinear phenomena.

The program just described runs fast enough for comfortable student interaction on an IBM PC-XT or AT with 8087 math co-processor.

INTERACTIVE COMPUTING IN THE TEACHING OF POPULATION GENETICS

Presented by: *Kenneth K. Kidd*
Yale University

One aspect of population genetics is the attempt to describe the forces that cause changes in genetic systems, i.e. evolution, and the attempt to understand how those forces operate and interact in causing genetic change. Many of the factors involved--natural selection, random genetic drift, linkage, etc.--can be described by simple mathematical equations relating the gene frequencies of one generation to gene frequencies in the subsequent generation as functions of various values of parameters representing the relevant forces. Because of these natural mathematical relationships, population genetics is the most mathematical, and in many ways the most abstract, of the sub-areas of genetics. This presents problems in teaching this subject to biology students, a sizeable percentage of whom eschew mathematics. While it is possible to emphasize the mathematical and formal theoretical aspects of population genetics, it is also possible to emphasize the consequences of the various relationships rather than the mathematics itself. It is in this area that interactive computing can be most helpful.

We have written a set of related programs which incorporate the relationships and, interactively with the student, simulate changes in genetic systems from one generation to the next. By using these programs, the student is able to choose the specific parameter values of interest to her or him and observe the consequences of those values on a particular population. While virtually all population genetics textbooks present specific examples of these relationships, those textbook examples cannot convey to a student the range of possibilities or allow the student to carry out the necessary recursive calculations by hand.

Initial tests on selected individuals indicate that the didactic purpose of these programs is well met. Individuals find the programs fun and very illuminating. The first full classroom test of these programs is underway in the Spring 1986 semester. We hope that students will find the programs easy to use and sufficiently fun that they will not only ask the "what if...?" questions but will find out the answers for themselves. Use of these programs should give students an intuitive feeling for the relative importance of the several different factors that affect evolution.

COMPUTER MODELS OF PLANT MORPHOLOGY AND EVOLUTION

Presented by: *Karl J. Niklas* (607) 256-8409
Cornell University

Biological concepts are potentially the most complex ones to communicate since organisms must be understood at many levels of structure and temporal scales simultaneously. This is particularly true of organic evolution and of explanations of adaptation.

The computer can be used in a classroom context to illustrate biological and adaptational principles by means of modelling. The student, by manipulating various parameters, either singly or multiply, can explore the hierarchical nature of biological systems, as well as gain insights into numerical and quantitative relationships between form and function. This is illustrated by two representative computer programs (MODEL and TREE).

MODEL deals with predicting the behavior of pollen grains within the aerodynamic environments created around the female organs of wind pollinated plants. It illustrates the influence of pollen size and density on the vectorial features of airflow motion, and hence on the probability of reproductive success. MODEL uses empirically determined airflow patterns and has successfully predicted relationships confirmed by research. It is a sophisticated research tool but ensures student- friendly usage.

TREE is a program capable of generating botanical trees based on parameters whose values are specified by the student. It also calculates the efficiency of the tree intercepting sunlight and sustaining the mechanical stresses of vertical growth. TREE can also be used to generate a "universe" of botanical forms and to select an "evolutionary trajectory" predicting how plants changed morphology through the last 350 million years of their evolution.

MODEL and TREE show how plants are constrained in their architecture by means of mechanical limitations. They also illustrate the relationships between form and function and the fact that these relationships are not simply tautological. Students are encouraged by these programs to "experiment" by manipulating morphological parameters, generate hypotheses, and test the results of these hypotheses. Hence the computer is used as a "laboratory" for growth of biological concepts.

INTELLIGENT TUTORS

Presented by: *Gregg Kearney*
Park Row Publishers

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SIMULATED POLITICAL ARENA (SPA)

Presented by: *Steven J. Rosenstone* (203)436-8529
Yale University

This simulation comprises a major component of a new, experimental undergraduate introductory course in Political Science. Most introductory courses are organized around a substantive theme (e.g. American Government, International Relations, Comparative Politics, etc.). In contrast, this course, "The Science of Politics," is organized around some fundamental concepts and ideas that we think are useful both for analyzing contemporary political issues and for developing political strategies for addressing problems in international politics, public policy, bureaucratic, legislative, electoral, and judicial decision making. The concepts we have selected have broad analytic power across the subfields of Political Science are are useful tools for understanding issues that arise again and again across historical periods, across institutional settings, and across political boundaries.

Our goal in this course is not only to expose students to a set of concepts, but to give them experience in applying those concepts to the political world. That is, we are trying to teach students to think critically and analytically about politics and to give them practice in doing so. Towards this end, we have created a Simulated Political Arena (SPA) in which the basic components of political decision making are simulated. Basic concepts such as varying political preferences, goals, and actions; changing political structures and political environments; the nature of political power; decision making under risk and uncertainty; and strategies for conflict and cooperation are represented in this simulation. The parameters of the a very basic version of the game are modified each week to accentuate each concept.

The simulation is written in Basic; uses color graphics, and runs on the IBM PC-AT. Students can play either against the machine or against each other. Both the course and the simulation are being used for the first time this semester with a class of 30 students. It is being taught by Professors Douglas Rae and Steven Rosenstone.

PDS - A SIMULATION OF COLLECTIVE DECISION MAKING

Presented by: *Mark Winer* (301)454-8759
University of Maryland
Coauthors: *Joe Oppenheimer,*
Hsiu Lu,
Ouqi Wu
University of Maryland

We're at a point in political science where we have good theory about a lot of things. Specifically, we have theories which predict well and are deductive or mathematical in character. Most of them come from game theory and are expressed as mathematical models. Unfortunately, they are often difficult to explain to undergraduate political science students, because they are conceptually quite complex. PDS is a program designed to allow undergraduates to grapple with, and apply, the mathematical models in simulated political environments. This lets them understand the concepts and logic behind the models without having to understand their mathematical complexity.

As a teaching tool, PDS involves students in constructing, and running actual social experiments. It permits the cheap and easy construction of a professional quality lab for introducing students to scientific techniques in social science and business programs. It permits even the beginning or freshman student to experience advanced social science research opportunities of generating and testing hypotheses.

PDS is a powerful general authoring system which can be used to write simulations or models of many social or collective decision processes. The program is designed to be extremely "user friendly". We recognize that the student or faculty member using PDS is not interested in the workings of the computer but would like only to harness its power at low start up cost. With this in mind, the program is fully menu driven and "very easy to learn".

The software permits an individual to author simulations of virtually infinite variety. The simulations can permit real players to have equal or unequal power to communicate and bargain. They can form coalitions or stay apart. They can have perfect or imperfect information about the actions and incentives others face. These simulations can be tailored to illustrate different theoretical and practical problems and to apply to differing pedagogical contexts.

DATABANK OF TREATY RESEARCH

Presented by: *Peter Rohn* (206)543-8030
University of Washington

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BACKGROUND AND CONTEXT. The databank of the Treaty Research Center (TRC) is the only facility of its kind in the world. It contains computerized information on all available treaties of the 20th century, nearly 50,000 treaties. Its primary purpose is research and publication and its main publication is the WORLD TREATY INDEX, a 5-volume reference work now in its second edition and in worldwide use.

INSTRUCTIONAL USE. The TRC databank can be and has been used also for undergraduate teaching. I have used various TRC printouts in teaching international law for many years. With a 1984 grant, we developed an instruction oriented offshoot of the TRC databank so that undergraduates could interact with a subset of the databank and obtain class-related data from on-campus terminals and even from their own home computers via phone modem. A major problem in this venture turned out to be the availability of time and funds for the Cyber mainframe as well as the status and availability of a mainframe-attached databank management system (System 2000). The problem got so bad in 1985 that instructional use ceased.

CURRENT DEVELOPMENT. We have, therefore, begun to change the hardware component from the Cyber mainframe to an IBM PC/AT and to convert the software from System 2000 to R-Base 5000 plus CLOUT. A pilot conversion has already moved about 500 treaties (1% of the databank) from the Cyber to the IBM CP/AT, and the prototype of a student-oriented storage and retrieval system is already up and operational for this 1% sample. We are now working simultaneously on the two next tasks, namely (1) improving the efficiency of the system so that it can be expanded gradually from 1% toward 100% of the databank without lengthening the response time prohibitively, and (2) simplifying and foolproofing the interactive mode of retrieval so that the system can actually be used by undergraduates without prior computer exposure.

GRAPHICS AND ANALYSIS FOR ARCHITECTURAL DESIGN

Presented by: *Lee B. Anderson*
University of Minnesota

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A key part of an architectural education is learning how to represent and solve complex problems graphically. Linked graphics techniques are used in all stages of the design process from early diagrammatic sketches showing site and programmatic considerations, thru to visual analysis of the final design. The graphics often represent entities which have values, such as square footages, costs and materials. These values form a database which can be analyzed in a number of ways, such as energy use or life cycle costing. Graphics oriented workstations may provide a new tool for rapid, integrated design and analysis of complex problems, and may suggest new ways of graphically representing design problems which were too complex or slow to analyze using previous tools. Techniques developed for architectural design may also apply to other disciplines which represent problems graphically.

In the initial phase of our AEP grant we are using networked IBM PC-AT workstations equipped with the professional graphics card and monitor in an architectural school studio environment. We are developing a system to rapidly and interactively enter, manipulate and analyze information relating to architectural design. Several modules are now in place including data entry from a digitizer and mouse, integrated analysis using a spreadsheet format, and color 3D graphics with shading and shadows. All program development has been using Turbo Pascal with hex graphics commands written directly to the PGC.

INTEGRATED DESIGN SYSTEM FOR THE IBM PC-AT INCLUDING A THREE DIMENSIONAL GRAPHICS PROGRAM, RULE BASED FRONT ENDS, AND INTERFACES TO COMMERCIAL DRAFTING, SPREADSHEET AND DATABASE PACKAGES

Presented by: *Gerhard Schmitt* (412)268-3528 GS@CAD.CS.CMU.EDU
Carnegie Mellon University

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The effective use of CAD in design education on affordable hardware is still suffering from missing links between available software. Although some packages are extremely powerful in their domain such as drafting, databases, and spreadsheets, no single program can presently address the entire range of quantitative, qualitative, and visual decisions facing the designer. We therefore started to link several existing packages and to add missing features to create a more complete, flexible system that allows various additions.

System Description

The IBM PC-AT was chosen as the implementation environment. Reasons are the rich existing software base and its widespread use in education and business. The development started with funding from CDEC at Carnegie-Mellon University. The following parts are implemented at present:

- A graphics program, DRAW, which is based on the GKS standard and features three dimensional extensions. Extrusions, axonometrics, one-, two-, and three-point perspectives, plan and elevation views are some of the alternatives. All the GKS options such as line types, fill patterns, and different colors are provided. The program is written in C. It can directly exchange drawings with AutoCAD. It can directly exchange data with Lotus 123™. It can be operated as a stand-alone package or as graphics output device of an expert system.
- Various rule based design front ends written in TOPSI, the AT version of OPS5. The graphic result of the design rules can be directly expressed with DRAW. These rule based programs can be developed into expert systems.

LOTUS 123 TRADEMARK OF LOTUS CORPORATION

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— Interfaces between DRAW and AutoCAD and Lotus™ 123. We find it important to utilize the capabilities of these commercial programs in our system. In addition, most students have at least a working knowledge of these packages. These interfaces allow graphic data to be input, expressed and manipulated directly in spreadsheet format or as AutoCAD drawings. These, in turn, can have non-numeric attributes that can be analyzed with dBase III.

— Plotter interface that allows the plotting of any object or text created with the above programs.

The system allows a large number of operation modes. For example, a design can be created using one of the rule based or expert front ends, displayed and visually edited with DRAW, dimensioned and supplied with attributes with AutoCAD, and analyzed or stored in dBase III. AutoCAD drawings can be displayed as perspectives with DRAW. Graphics information entered in DRAW can be used in Lotus™ 123 for simple cost or energy analyses (these 123 programs were previously developed by us). More complete analysis programs can easily be added. The data transfer between the different programs works fast. We intend to run the parts of the system that we developed - such as DRAW - in the Andrew environment. As all our software is written in C, we expect no major problems.

VEGA: A GEOMETRIC MODELLING SYSTEM

Presented by: *Rob Woodbury* (412)268-3596 CAD.CS.CMU.EDU
Carnegie Mellon University

VEGA is a program which models rigid solid objects in three dimensions. Specifically, its domain is assemblies of planar faced polyhedra which may be created with a variety of operations.

VEGA is intended to serve two purposes, that of a new medium of representation for the design process and of a programming package to support geometric applications in a wide variety of domains. Here we address primarily the first of these purposes, that of a new medium for design.

Designers of physical objects use an external medium, traditionally paper or physical models, not only to record their work, but to provide information which assists in the understanding of implications of design decisions. Designers proceed by performing operations, which reflect internal design decisions, on this external medium.

The operations used in design are generally reflective of these physical media. For example, models built of clay tend to form by a subtractive processes, whereas models built of wood tend to be additive in nature. Designers who use drawings as their medium still tend to use operations which reflect operations on physical models.

Computers provide the fascinating potential to provide a much wider variety of operations at a much greater speed than is available with the traditional means of representation. In addition, a computer based representation can provide quantitative information not easily accessible from traditional forms. This opens the potential for the inclusion of formal means of evaluation in the design process; something which is generally almost absent in traditional design teaching. A computer program which effectively and "naturally" models physical objects and operations on them would be a valuable assistance to both the teaching and practice of design.

VEGA has been designed with these objectives in mind. It is currently undergoing redesign and additional implementation at the Center for Arts and Technology at Carnegie-Mellon University. VEGA represents physical objects with a scheme known as boundary representation and provides a wide variety of operations on these objects. VEGA also provides means to associate other, non-geometric, information with the objects it represents. VEGA is implemented under the ANDREW system. It communicates to ANDREW through a graphics package, also developed by our group. VEGA is intended to serve as a medium for future studio courses in the Architecture, Industrial Design and Arts education. We have recently embarked on a project to make VEGA truly useful for these purposes.

NEW ELEMENTARY PHYSICS LABORATORY EXPERIMENTS

Presented by: *Ulrich Kruse* (217)333-4169
University of Illinois
Coauthors: *D. J. Kane, J. H. Smith*
University of Illinois

Four new laboratory experiments using IBM computers have been introduced in Physics 106, Mechanics, at the University of Illinois at Urbana-Champaign. Physics 106 is the first semester in a three-semester general physics course for scientists and engineers. There were 465 students enrolled in the Fall of 1985 who used the new equipment.

Three of the four new computerized experiments involve the motion of gliders on nearly frictionless air tracks. Students explore Newton's Second Law ($F=m*a$), Energy Conservation, and Collisions. The fourth experiment uses a torsional pendulum for the study of an oscillating system.

The IBM computers are used for data acquisition, data processing, data plotting and printing as well as student-computer dialog. The new experiments were impossible without computerized data acquisition. The students now explore new phenomena, such as the motion of a system with a magnetic braking force, and examine other arrangements such as the torsional pendulum in much greater detail and with much higher accuracy.

The data are acquired with a homemade data acquisition board which accents the signals from photodetectors looking at mylar tape or disk encoders. The encoders have alternating black and clear stripes which measure the position of the gliders to an accuracy of 125 microns (1/8 millimeters) or measure the angle of a disk to an accuracy of 3 millirad.

During the experiments, the computer asks the students to make important predictions before the data runs. Only after they have answered the questions correctly can they take the actual data. The computer program tries to be helpful in handling student answers: if some simple typing error occurs (such as an extra decimal point) the computer points to the place of confusion and asks for a correction. If the answer is off by a factor of ten, the computer furnishes a helpful hint. During data acquisition, the positions are plotted in real time so the student can see the correlation between the actual motion and the data plots. They then select the portion of the data they wish to process. Only after each student has processed the first few data points correctly, will the computer quickly handle the remaining data points.

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The Tencore computer language has been used to write the main routines in the program with data acquisition and rapid plotting written in assembly language. This system has turned out to be very flexible. Several changes have already been made in response to suggestions from students and staff and further improvements are being made for use during the spring semester when about 1200 students use the equipment.

COMPUTER GRAPHICS UTILITIES IN SPECIAL RELATIVITY

Presented by: *Edwin F. Taylor*
Massachusetts Institute of Technology

Special relativity describes phenomena remote from common experience: the world of the very fast. Computer models display surrogate worlds that students can explore and manipulate to help them visualize the real one.

Students (63% sophomores, 61% physics majors) in an MIT class in special relativity used several graphics utility programs in solving homework and examination problems. VISUAL APPEARANCE shows a rudimentary speed-distorted landscape seen through the windshield of a rocket ship moving under operator control. OBSERVER displays meter sticks and clocks viewed by an observer who can ride with either laboratory or rocket frame. SPACETIME DIAGRAM plots space and time coordinates of events, constructs relations among them, and transforms them between frames in relative motion. COLLISION analyzes interactions between particles: collisions, creations, decays, annihilations, and transformations.

Students appreciate the utility aspect of these programs that allows them to solve a greater number of more difficult problems than would be possible otherwise. Some want to be sure that computer use augments rather than replaces hand-solved exercises. Both students and teacher report that the displays help them to visualize the subject.

GEOMETRICAL AND PHYSICAL OPTICS

Presented by: *Ned S. Vander Ven* (412)268-2766 TD.CC.CMU.EDU
Carnegie Mellon University

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1.) In geometrical optics, a general ray-tracing program permits students to carry out exact numerical ray-tracing calculations for a system consisting of an arbitrary number of spherical refracting surfaces, with graphical presentation of the results. An optical system can be built up out of a small number of basic elements: simple lenses, cemented doublets and aperture stops, whose parameters are entered into a simple text document. Once the system parameters are specified, a scaled cross-sectional view of the system can be drawn, together with the trajectories of meridional rays that have been traced through the system by exact numerical algorithms. Numerical data for the drawing and ray-tracing programs are obtained by parsing of the text document, so that the system design can be easily modified by on-screen editing with a general-purpose text editor. The data document, the graphics region, and a lesson document are all simultaneously visible in specified regions of the window. Among the problems that students can study are the spherical aberrations of a simple lens and the effects of "bending", the reduction of spherical aberrations by a carefully designed cemented doublet, and the further reduction of aberrations by more highly corrected systems. Aberrations, such as coma and field curvature can also be studied. Although a thorough study of these other aberrations requires that skew rays be traced, some of their affects can be seen by tracing meridional rays.

2.) In physical optics, the intensity distribution in Fraunhofer diffraction can be studied in detail by the use of a general graphing and calculating program developed by Bruce Sherwood at Carnegie-Mellon. Mathematical expressions to be graphed are entered as text, compiled by an "expression compiler" and then plotted on an appropriate set of axes. As in the ray-tracing program, expressions and parameters can be readily changed by editing the text with a general-purpose editor. Students can easily plot the diffraction patterns from a multiple-slit array and observe the effect of varying the number of slits as well as the ratio of slit width to slit spacing. The program is particularly useful for plotting the intensity distribution of Fraunhofer diffraction by a single slit having a non-uniform transmission, in order to study the phenomenon of "apodization", the reduction of secondary maxima in the diffraction pattern by an appropriate choice of aperture function.

3.) Although the effects of a non-uniform aperture function can be readily calculated, it is difficult to observe them in the laboratory part of the course, owing to the unavailability of slits with varying transmission. Using the graphics capabilities of the Andrew environment, we have constructed wide (2 cm) single slits of varying trans-

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mission by varying the density across the aperture of randomly-placed dots (each dot being one pixel in size). A printout of the screen is then photographically reduced to give a slit of the desired width, typically about 0.5 mm. We have made slits with triangular, stair-case, and Gaussian transmission whose Fraunhofer diffraction patterns show clearly the phenomenon of apodization.

CALCULUS SOFTWARE DEVELOPMENT ON THE PC AND RT - A COMPARISON

Presented by: *Russell C. Walker* (412)268-2545 TF.CC.CMU.EDU
Carnegie Mellon University

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The goal of this presentation is to discuss a software development project which began on a IBM PC, and is being ported to the ANDREW system on the IBM RT. The PC software consists primarily of a variety of graphical demonstrations of calculus concepts. Included are integration, root determination, Taylor's formula, differential equations, trigonometric functions, the limit, polar coordinates, and the graphing of surfaces. The original PC software is in BASIC.

The RT implementation will rely primarily on the language CMU Tutor developed to facilitate the creation of instructional software. Early indications are that the special provisions of CMU Tutor for function graphing, handling interactions with the student, and displaying text will enhance the effectiveness of the software as well as the speed of development. Finally, the greater speed of the RT and eventual ability of CMU Tutor to access other languages and ANDREW utilities should greatly extend the scope of problems that can be considered.

AN AUTHORING SYSTEM AS A TOOL FOR FOREIGN LANGUAGE LEARNING

Presented by: *Deborah McGraw* (607)256-2322 B47 @ CORNELLC
Cornell University
Coauthor: *Slava Paperno*
Cornell University

The problem tackled by the Department of Modern Languages and Linguistics German/Russian project was: how to make the necessary drill and memorization of foreign language learning more interesting and efficient for our students. We decided to use computing technology to create a tutorial for elementary German and Russian courses. In Summer Session 1985 our students first used the courseware we developed as an optional tutorial. The students reported that they increased their vocabulary and confidence in using grammatical concepts. The computer tutorial helped the students improve their reading and writing skills. In addition, the confidence they gained helped improve their listening and speaking skills in class, as well as their performance on standardized tests.

An evaluation of the existing commercial authoring system, showed that they were inadequate for our purposes. Some of their drawbacks resulted from the fact that they were not created for foreign language instruction. Some simply could not use foreign character sets. They did not include data bases, and no existing data base could handle foreign alphabets. Thus we needed tools that were new both from the conceptual and from the practical point of view. We ended up using an existing authoring system (LAB) and significantly changed it in the process, through our close collaboration with its author, Dr. Edward N. Adams. We created utilities that support the use of foreign character sets. We also created a set of tools to go with this authoring system, which we based on Turbo Pascal tool sets. Our next step will be introducing an audio component, based on IBM Voice Communications Option.

BILINGUAL WORD PROCESSING

Presented by: *James S. Noblitt* (607) 256-4087 AIFJ @ CORNELLA
Cornell University

Educational Goal -- The foreign language student must be able to access a great deal of lexical information in the course of becoming literate. (An abridged dictionary for adults commonly includes about 30,000 items.) The physical labor of searching through a dictionary is notoriously tiresome, and some skill is required in selecting lexical items appropriate for a given context. We set out to design a tool which would assist the foreign language learner by reducing the amount of labor associated with correct word choice, spelling, and inflectional form. The result was a foreign language word processor which provides assistance at various skill levels in developing competence in a foreign language.

Computing Strategy -- We set out to design a general purpose program which could be applied to any language. Accordingly, we addressed three main concerns: the user or student), the author (or data entry personnel), and the programmer. Using French as our language data base, we designed a program to present the user with rapid access to vocabulary through translation equivalents or partial entry in the varget language. Also available, on demand, are full expansion of verb forms, examples illustrating usage, and grammatical notes. We foresaw that this tool could be used with existing courses if provision were made for examples drawn from material familiar to the student. We therefore developed at the same time a procedure for an author to add entries, examples, and explanations as desired. Finally, we took care that the programmer incorporated basic linguistic considerations in determining the rote and rule-governed aspects of the lexicography involved.

SHARPENING LANGUAGE AWARENESS THROUGH THE RESTORATION OF WORDS DELETED SYSTEMATICALLY FROM TESTS: A LEARNING AND TESTING DEVICE TO SUPPORT INTEGRATIVE LANGUAGE TEACHING

Presented by: *John Barson* (415)497-4204
Stanford University

Cloze tests - texts with some of the words replaced by blanks - are used in language teaching and testing. The program, entitled "Blankety-blank," generates cloze tests from disk-based text files. Each word in the test file is coded for part-of-speech. This allows students to make use of a help facility to ask what part of speech the word for a particular blank is. This program is an integrative teaching tool as well as for testing.

SOFTWARE FOR PRINTING SOUTH ASIAN SCRIPTS

Presented by: *Donald A. Becker*
University of Wisconsin, Madison

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American teachers of South Asian languages have in the past been hard pressed to find adequate readings, grammatical exercises, and bilingual dictionaries for their students. As a consequence, virtually every veteran instructor of a South Asian language has been forced during his or her career to devote a great deal of time and effort to the production of supplementary teaching materials. Although these materials have often been excellent in terms of their pedagogical content, their outward appearance has left much to be desired, since the lack of typesetting facilities for Indic scripts in this country has forced their authors to write them by hand or type them on mechanical typewriters capable of producing only a very rough approximation of a typeset text. The typographical unsightliness of these works has generally prevented their publication. They have, instead, have been distributed (in Xeroxed or Dittoed form) only to their author's own students. Their potential usefulness has accordingly not been realized.

Our project is attempting to demonstrate that an IBM PC can remedy this situation by providing instructors of South Asian languages with a convenient and inexpensive means of producing high-resolution, camera- ready copy in various writing systems of the Indian Subcontinent. The project involves the construction of printer driver programs for the IBM PC that enable their users to compose South Asian texts in Roman transliteration with the aid of standard word processing software for the IBM PC, save these texts in standard PC DOS (ASCII) files, and then print out, with a Toshiba P1340 dot matrix printer, a final hard copy on which all non-English words are transliterated into one of three target scripts: Devanagari (the script of the languages Hindi, Marathi, Nepali, and Sanskrit), Telugu (the script used for Telugu and sometimes Sanskrit), or the specially modified variety of Arabic script in which Urdu is written. My presentation will outline the structure of the source code for one of these compiled BASIC printer drivers. Included in this outline will be a description of an abbreviative notation I have developed for sending instructions to a dot matrix printer--a notation that not only shortens considerably the amount of code needed to generate a particular character but also makes graphics programming much more intuitive. I shall also describe a programming trick which has allowed me to create surprisingly simple programs that convert the words of an Indic text file into a vocabulary list ordered according to the alphabetization rules of the appropriate writing system. These alphabetization utilities, when used with another short program which merges pairs of alphabetized lists, enable a language teacher to construct quickly and easily a comprehensive glossary for a set of lessons that he or she has devised. Finally, I shall compare my transliteration-based method of printing South Asian scripts with the font-based approach which has been used by several South

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Asianists, including myself, to process various Indian languages on the Apple Macintosh. I shall argue that the expedient of using a romanization as an input vehicle actually makes my method more user-friendly than the Macintosh font-based approach. Printer driver software for Devanagari and Telugu will be demonstrated together with my alphabetization utilities for the latter script.

RT PC SYSTEMS ARCHITECTURE

Presented by: Presented by: *William J. Spalter*
IBM ACIS

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An overview of an architecture based upon a RISC engine and a high level machine interface.

THE INTERLEAF WORKSTATION PUBLISHING SYSTEM

Presented by: *TBA*

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A look at the functional capabilities of the RT PC WPS by Interleaf. This presentation will give an explanation to the underlying architecture of WPS from a developers perspective.

RECENT ADVANCES IN A.I.

Presented by: *Frank C. Tung*

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A review of what is going on in IBM Research Labs and Scientific Centers in the area of Artificial Intelligence.

UNDERSTANDING AND USING THE GRAPHICS DEVELOPMENT TOOLKIT (VDI)

Presented by: *William G. Tuel, Jr.*
IBM Palo Alto Scientific Center

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The Graphics Development Toolkit (VDI) is a device independent interface to the graphic hardware on the PC and on the RT/PC. The VDI shields the application from device variations by using dynamically loadable device drivers. This also makes it possible to route graphic output from display to hardcopy with no change in programming. A file interface is also available.

In this talk, the major VDI functions will be discussed and illustrated. The presentation will indicate which types of applications should consider using VDI, and which may be more suitable for a higher level interface, such as GKS or graPHIGS. The speaker will draw on his own experience with VDI.

ADDING DEVICE SUPPORT FOR AIX

Presented by: *TBA*

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How IBM maintains an open architecture and allow for the addition of devices drivers into a software base (AIX VRM) for which source code is not made available.

TOOLS AND METHODOLOGY FOR EVALUATION OF INSTRUCTIONAL COMPUTING PROJECTS

Presented by: *Michelle Comeaux* (608)262-5667
University of Wisconsin
Coauthor: *Clifford B. Gillman*
University of Wisconsin

While the use of microcomputers for instructional purposes has mushroomed in recent years, the development of appropriate evaluation tools and methodology has lagged far behind. Developers of instructional software want to be able to evaluate their instructional programs as they are being pilot tested as well as to compare their instructional software with more traditional methods. However, they often lack the tools and methodology for assessing the effectiveness of their new programs. As the evaluation consultants to Project TROCHOS at the university of Wisconsin-Madison, we have designed an evaluation model that is flexible enough to apply to the programs of all our project investigators, yet specific enough to meet the individual needs of a variety of content areas and instructional objectives.

The design of an evaluation model for Project TROCHOS entailed several steps. First, we created a system for categorizing the various projects by instructional objectives. For example, some projects are developing software that simulates expensive laboratory equipment, such as an NMR spectrometer, while others are providing the students with heuristics for problem solving in a content area. For each category (a total of eight in all), we then developed evaluation tools and a methodology appropriate for the instructional goals of that type of program. Next, we established both quantitative and qualitative procedures that could be used for all projects at differing levels of implementation. Last, we tested our model on two projects - one which seeks to improve pharmacy students' patient medication problem solving skills and the other which trains chemistry students how to use an NMR spectrometer via a microcomputer simulation of that instrument. The results of these two pilot tests will be discussed in our presentation.

In our talk, we will review our evaluation model, discuss its development, and describe the procedures we use with our project investigators. In addition, problems/concerns we've encountered and lessons we've learned will be shared with the audience. While we have no software to demonstrate, we do have various evaluation measures and tools that attendees could examine during demonstration time and we could be available to answer specific questions about our model.

STUDYING COMPUTER INTERVENTION IN A COLLEGE COURSE

Presented by: *William O. Beeman* (401)863-2254 WOB@IRIS
Brown University

Brown University, in conjunction with the Annenberg/CPD Project has undertaken a program of development of base-line tools to be used by faculty for independent development of computer-based educational materials in college courses. The tools are to be implemented in three pilot courses over the next three semesters. The Office of Program Analysis at IRIS has undertaken a research project to assess the effects of using these materials in the three courses. Methodology is based on a combination of ethnographic observation, intensive interviewing and survey. The pilot courses have been observed first in "unenhanced mode" without the use of computer-based materials. They will now be observed in "enhanced mode" using these materials. The first course of the three, an English literature survey course, is being taught during the current semester. This presentation will discuss the methodology and preliminary results of the analysis made by the research team. The changes observed in student and instructor educational goals and strategies, student and instructor use of time and educational resources, and student learning processes will be discussed, as well as the techniques of analysis used in drawing conclusions in the study.

EVALUATION FOR PROJECT OLYMPUS

Presented by: *Greg Zick*
University of Washington

COMPUTERIZED TEXT ANALYSIS AND DATABASE MANAGEMENT AS TECHNIQUES IN MUSICOLOGICAL ADVANCED STUDY

Presented by: *John Hill* (217)333-0371
University of Illinois

Professor Hill's spring seminar, "The Italian Contrafactum from the Renaissance to the Eighteenth Century," is the first of the series of courses in the Musicology Division that will use the IBM computers awarded under Project Excel. It takes as its starting point a database with associated processing, transformation, storage, sorting, retrieving, importation, and exportation tasks programmed by Professor Hill using the Savvy PC relational database system language. This database contains all the texts for all the arias sung in all known productions of all operas by Antonio Vivaldi. Its purpose is to identify, by using established analytical criteria, pairs of groups of texts that apparently were sung to the same music. This information cannot be attained by consulting the musical scores themselves, since in most cases only the text books of the operas survive. Although Vivaldi set new text to old music very often, usually the music survives with only one of the several texts to which it was sing in his various operas. Among the tasks that Professor Hill has devised are some that count and record the number of syllables in each line of poetry, that compare the content of each aria text with that of every other text and record the results, and that provide a split-screen display for reviewing the results of each series of comparisons.

The graduate musicology students, during the spring-semester seminar with Professor Hill, will program similar tasks in order to carry out projects aimed at discovering similar instances of putting new text to old music in three other repertoires from the late fifteenth to the early seventeenth centuries. Some dramatic results can be anticipated, which will have a significant impact on music historians' understanding of religious and theatrical music and music-text relationship over 250 years of Italian music history.

THE MUSICIAN'S WORKBENCH: FOUNDATIONS FOR COMPUTER ASSISTED EDUCATION IN MUSIC

Presented by: *Roger Dannenberg* (412)268-3827
Carnegie Mellon University

The Musician's Workbench Project is intended to address the problems of developing computer applications for student and professional musicians. A basic tenet of the project is that conventional computer systems are not useful to musicians without augmentation of both hardware and software. In particular, a musician requires high-quality audio output, very high performance in real-time applications, and an interface based on graphical, music notation rather than the text strings and graphics used by more conventional computer interfaces. In addition, music application programmers should be provided with an environment that avoids the necessity of developing a new music editor and synthesizer for each application. The Musician's Workbench addresses each of these points, providing a foundation on which a large number of coherent applications can be developed at low cost.

Current Status

We have implemented a data structure for music representation which allows arbitrary properties to be attached to objects and supports multiple hierarchies, multiple views, incremental display update, and an Undo facility. The structure has been used to construct a very simple music editor, and enhancements are in progress. We have also worked with Peter Comerford at the University of Bradford to develop a low-cost, high-performance signal processor, the BMIS, for music synthesis. We have just completed real-time control software that will give us flexible control over the BMIS, and we are testing some instrument simulation software.

Because we have an immediate need for a computer music system, we have also developed a small collection of programs that are now operational and in use for teaching Electronic and Computer Music. The programs consist of a compiler and player for a music language Adagio, a transcription program that converts a keyboard performance into Adagio, and a set of C routines for writing real-time music programs. The system runs on an IBM XT or AT with a Roland MPU-401 MIDI interface and any MIDI compatible synthesizer.

MUSICAL ACOUSTICS DEMONSTRATION/ LESSONS

Presented by: *James Beauchamp* (217)333-1089
University of Illinois
Coauthors: *Robert Maher*
University of Illinois

■

We are developing a series of demonstration/lessons for an acoustics course which is offered by the UIUC School of Music. The demonstrations are designed to cover a wide range of topics from simulation of basic wave phenomena to sound synthesis demonstrations (including timbre and tuning systems) to acoustic signal analysis. They are designed to be interactive in order that the instructor may use several different paths to illustrate various possibilities in class and so that they are varied enough to involve the student in a learning situation out of class. Presentations are enhanced by the use of Professional Color Graphics animation, fast Fourier transform hardware, high speed 12-bit DAC's for waveform synthesis and 12-bit ADC's for analysis, and MIDI control for demonstration of music contextual effects. All software is being generated using Lattice C, the IBM Graphics Kernal Package, and the IBM Macro Assembler.

A "LANGUAGE LAB" FOR ARCHITECTURAL DESIGN

Presented by: *Arch Mackenzie* (607)256-5236
Cornell University

Much that architecture schools have to teach is embodied in architectural languages. Since Vitruvious codified the elements and principles of classical architecture, architects have written dictionaries to record the evolution of styles. The "linguistic" approach epitomized by the curriculum of the Beaux Arts is reemerging as a focus of design education. Criticism, which is the one-on-one instructional mode of the traditional design studio, if often couched in linguistic terms. Students learn to build "vocabularies," to understand the "syntax" of style and to "read" compositions.

A central flaw in studio-centered architectural education, however, is that these language lessons are often taught amid a sea of other creative concerns. On the other hand, efforts to teach languages methodically flounder because of the tedium that results from the need to manually represent many variations. Moreover, there is a great disparity in the rate at which different students absorb these lessons.

This presentation will discuss a "language lab" strategy in which traditional studio learning may be supplemented by language exercises using computer graphics techniques. It will outline the specifications used to design a language lab software package for the PC/AT, demonstrate key functions and illustrate a student session in situ, using materials produced on the system.

EDUCATIONAL SOFTWARE FOR STRUCTURAL ENGINEERING

Presented by: *Irving Oppenheim* (412)268-3777
Carnegie-Mellon University
Coauthors: *Mary Lou Maher*
Weiguang Zhang
Carnegie-Mellon University

■

Structural engineering education is enhanced by educational software when the software provides many diverse problems to solve, graphical representation of the problem and solution, and immediate response to complex calculations. This presentation includes two efforts to provide such software at different levels of structural engineering education. The first effort resulted in a problem generator, SSSDS, for a course in structural analysis. The second effort resulted in a graphical environment, SDI, for structural system design.

SSSDS is a program that Synthesizes and Solves Statically Determinate Structures. The motivation for this project is to provide the student with an unlimited source of problems, complete with graphical display, an online calculator, and the solution. The student or instructor may specify the degree of difficulty of the problem by selecting a few parameters that describe the class of problems to be generated. The details of the problem, such as load locations and magnitudes, are randomly generated. The program may be used to generate a problem randomly, generate a partially specified problem, or regenerate a problem previously generated. The program runs on an IBM PC and is implemented in Turbo Pascal.

SDI is a Structural Design Interface that aids the student in solving structural design problems. User interaction occurs graphically; the user can design a structure by manipulating icons that represent structural components and subsystems. The program provides a database of structural shapes, an on-line calculator, a stability and completeness check, and an automatic interface to an analysis program. The purpose of the program is not to synthesize problems for the student, but to provide an environment in which the student may explore solutions to structural design problems with immediate feedback on the geometry and topology of his design and the behavior of the resulting structural system. The program runs on an RT machine under the Andrew environment.

A MICROCOMPUTER DESIGN TOOL FOR LEARNING ENERGY CONSERVING

Presented by: *Murray Milne* (213)825-7370
University of California, Los Angeles

■

SOLAR-5 is a learning tool that shows students a picture of the energy implications of their architectural design decisions. In the required graduate course in Building Climatology it serves as the vehicle for students to test and compare design alternatives.

SOLAR-5 is written for people who know a lot about architecture but virtually nothing about computers. For example, it was created specifically to help architects understand the energy implications of alternative building forms during the critical early moments of a design project. This is when the building is only vaguely defined. It is also the time when architects must make a great many design decisions which will determine their building's ultimate energy performance.

Creating micro-computer software to blend graciously with architect's design process is itself a challenging design problem, probably more of an art than a science. In developing SOLAR-5, a number of principles evolved; the most important is that right brain thinkers need graphic learning tools.

Architects do most of their thinking on the right side of their brain where there are no words and no numbers only shapes and forms. Architects can construct a right-brain image of a building and can "imagine" themselves walking around inside it. throughout their careers, they become increasingly skilled at this kind of spatial thinking and at graphic (non-verbal) communication. For architects, learning tools which present information in graphic form will be inherently more successful than if that same information was presented as a table of numbers or a paragraph of text.

Imagine, for example, the problem of trying to give the architect a picture of the annual energy performance of his building as a table of numbers for all 24 hours of the day and all 12 months of the year. It would be almost overwhelming! We have found instead that if we present this same information as a 3-dimensional plot, architects quickly learn how to develop an overall image of the building's annual performance and soon are able to pick out subtle trends caused by details of the building's design. With a bit of practice, architects soon can simultaneously manipulate both images of the building in their mind, mentally re-designing the building itself, then imagining how the shape of its performance plot will change.

DYNAMIC SIMULATION USING ADAMS2D ON THE IBM PC/AT WITH PROFESSIONAL GRAPHICS MONITOR

Presented by: *Richard C. Coddington* (217)333-8355
University of Illinois

■

ADAMS2D is a user friendly, interactive program for the analysis of dynamic response of constrained, plane motion of mechanisms. It was modified to run on the IBM/AT and first used in Ag Eng 436, Dynamics of Farm Machine Elements this past fall. In a nutshell, ADAMS2D:

- automates construction of the equations of motion for constrained, plane motion of mechanisms
- applies constraints consistent with user prescribed pin and translational joints
- solves for the equilibrium position of the mechanism
- numerically integrates the equations of motion and invokes equations of constraint
- displays response as
    - — plots of position or speed of user specified links
    - — plots forces or torques at user specified joints
    - — plots the family of positions of the mechanism for user specified times

Color graphics enhances the visual interpretation of both the models and the mechanical system response. Color coding of the elements comprising the mechanical system makes it easy for the user to visualize the model of his/her mechanism.

ADAMS2D has many uses. Among them are design of linkages, response of suspension systems, analysis of engine components, ride quality of vehicles, steering characteristics of vehicles and many others. Specific applications to date include simulations involving compaction of hay by a baler-plunger mechanism, ride of a tractor, steering of an articulated tractor, three point hitches with control and dynamics of a backhoe on loader-backhoe unit.

COMPUTERIZED INSTRUCTION IN ENGINEERING THERMODYNAMICS

Presented by: *S. A. Klein* (608)263-5626
Coauthor: *W. A. Beckman*
University of Wisconsin

A computerized instructional program for thermodynamics has been developed for engineering students in their first and second courses in thermodynamics. It is a highly interactive program, centered around problem solving.

Upon startup, the student is presented with a menu listing topical areas such as Basic Concepts, First Law Problems, Vapor power cycles, Refrigeration cycles, Psychrometrics, Combustion, etc. After selecting one of these topics, a second menu appears offering more specifics about the available problem types. After a selection is made, the program will generate a problem and display the problem statement and figure indicating state points and other information. The student must now choose a thermodynamic system and an operation such as a mass, energy, or entropy balance, property table evaluation, efficiency definition, etc., which he wishes to perform. The equation appropriate to the operation is either displayed or the student is prompted to enter the equation. In the latter case, a list of allowable symbols is supplied and the equation is entered using symbols selected from this list. Any algebraic equivalent of the correct equation is accepted. The student is invited to enter the value of any unknown quantity in the equation. When only one unknown remains in the equation, the computer solves it and displays the result. At any point, the student may reprint the problem statement, display the figure, list the current status (i.e., the variables already found), obtain a nomenclature list, access "built-in" property tables or ask for help.

The HELP option is the central focus of the program. The student may request help at any point. The advice he receives depends on the operation the student is working on and his past progress. The program first provides a clue such as "Try choosing a different system", or "You have a sign error in your equation." If additional help is requested, more specific information is supplied such as "Try the ENERGY BALANCE", "In order to find the volume, you must first find the temperature at state 1". Finally, if requested, the HELP processor will provide the needed intermediate result or equation. HELP will always lead the student through the problem along a path initially chosen by the student. A score and elapsed time are maintained and optionally displayed. The score is decremented each time the student provides an incorrect response or asks for help.

Continued

This program is not intended to replace either the lecture or the text, but rather provide an alternative to conventional homework problems. The computerized instructional program offers several major advantages over the conventional paper and pencil approach. First, in the event that the student is stuck and cannot solve the problem, he can obtain a hint or a specific suggestion with the HELP feature. The alternative with the conventional approach is to ask the instructor or simply not continue working on the problem. Second, the computer eliminates the work associated with solving problems, such as looking up properties in tables and doing algebra. The program currently has about 100 problems which can work in either English or SI units.

THE USE OF INTERACTIVE THERMAL FINITE ELEMENTS (ITEM) IN AN UNDERGRADUATE HEAT TRANSFER COURSE

Presented by: *A. F. Emery* (206)543-5338
University of Washington

One of the common problems in the teaching of heat transfer is the lack of a method to visualize the interactions between the temperature and heat flux distributions. For example, radiative heat flux is proportional to the fourth power of the temperature. Thus, small changes in T lead to large changes in O. In reality, it is rare to have temperature defined boundary conditions: most are somewhere between prescribed T and prescribed O. But large changes in O imply only small changes in T: yet it is temperature, which is sensed and best understood by the student. Consequently, the student has a difficult time visualizing how the temperature field changes as boundary conditions change and how it is related to the heat flux.

Probably the best solution to this problem is an interactive thermal element program (ITEM) with color graphics display of heat flux and temperatures. Using ITEM, the instructor can demonstrate in class or the student can investigate, at leisure, a wide range of values of k/k and gain an understanding of the complex relationship between O and T. It is critical that the program and the graphics be fast: this is fairly easy to achieve. The program must be menu driven for flexibility, yet command structured to ensure that the student is adequately directed in the development of the solution: these are contradictory requirements.

This paper describes the pedagogical principles underlying the development of the ITEM: how the menu and the command structures were merged: how it differs from the construction and use of the typical research finite element program: how it is integrated into the class material: and how the students have responded to it. If possible, a large screen projected IBM/AT will be used to demonstrate the ITEM program during the presentation, particularly the "What-If" capabilities of ITEM, which are the basis of its success, not only in the classroom, but in fact in the research arena.

A MICROCOMPUTER-BASED HYBRID (SYMBOLIC-NUMERIC) SYSTEM APPROACH TO NEAR OPTIMAL DESIGN OF MECHANICAL COMPONENTS

Presented by: *David A. Hoeltzel* (212)280-8372
Coauthor: Columbia University
Wei-Hua Chieng
Columbia University

A hybrid (symbolic-numeric) system, referred to as OPTDEX, (OPTIMAL DESIGN EXPERT) for the optimal design of mechanical components and systems has been developed. The system is written in Golden Common LISP and IBM Professional (Ryan-McFarland) FORTRAN for execution on the IBM PC/AT microcomputer. Graphical output has been implemented using the Graphical Kernel System (GKS) standard. This microcomputer-based implementation makes the system particularly attractive as an easily accessible, engineering analysis tool which can be utilized for "real-world" design problems as well as for instructional engineering design.

Experience with the system indicates that the time required to achieve, at least partially optimized engineering design solutions, is similar to that which may be expected with standard, nonoptimization-based microcomputer computation. Any added computational time may be justified and subsequently offset by increased long term design efficacy.

The OPTDEX protocol assumes a modular form whereby each level can be modified, updated, and enhanced independently of the others to accommodate various design philosophies and the subdivision of large scale design problems. A "design cell" approach has been adopted which has the capability of addressing the design of various mechanical components and systems. The current version of the OPTDEX design cell library, which is undergoing revision and expansion, includes speed reducer, bearing, coupling, and shaft design capabilities.

This modular structure and generalized design cell approach, which underlies the OPTDEX system, establishes the basis of a formalized methodology for mechanical engineering design which may be extended to include other design related disciplines as well. For example, with the addition of appropriate design cells, the system can be configured for VLSI circuit design in electrical engineering, scheduling and job routing in industrial engineering and structural design in civil engineering. Clearly, the system has potential as a multidisciplinary instructional design and analysis tool whereby students and practicing engineers can become acquainted with the application of artificial intelligence (expert systems) programming techniques to engineering design problems.

Continued

Presently, optimization in engineering design is an all too underutilized means of achieving significant engineering design refinements. This is primarily due to the high level of sophistication required to apply optimization techniques successfully as well as the general lack of availability of easily implementable design optimization codes. In short, an expert is typically required to formulate and guide a design optimization problem through to successful fruition.

In an effort to remedy these shortcomings, attempts are being made to simplify the application of nonlinear optimization algorithms in engineering design practice. Recently, a number of investigators from fields such as mechanical engineering, Jha (1), systems engineering, Betts (2), and applied mathematics have begun to consider the problem:

Artificial Intelligence
+
Mechanical Design
+
Optimization Method
=
Expert System For Optimized Mechanical Design

While progress in expert systems research has been made in several specialized mechanical design areas such as linkage synthesis (3) and air cylinder analysis (4), a general underlying theory of what an expert system should be within the context of a mechanical design problem remains unresolved by the artificial intelligence in design research community. Rasdorf (5) and Brown et al. (6 offer some important insight into this problem. Betts (2), emphasizes the need for a careful interfacing of needs and requirements between optimization algorithms and engineering systems to which these algorithms are applied. It is here, where mismatch between theory and practice occurs, that advances must be made if optimization is to be readily understood, implemented, and applied to "real-world" design problems.

From a systems engineering standpoint the problem appears to be one of determining an appropriate hierarchy of design, optimization and artificial intelligence factors for problem formulation as well as the effective generation (implementation) of numerical procedures (algorithms) for problem solution.

The OPTDEX system affords a structured approach to engineering design optimization which can span numerous engineering specialties. The system offers a general methodology for design optimization problem formulation and solution.

INNOVATIONS IN HIGHER EDUCATION: A MULTIMEDIA DEVICE

Presented by: *Bruce Tetelman* (212)280-3758 CU.TETELMAN@CU20B
Columbia University

■

Educators are always seeking ways of improving the teaching process with the use of new technologies. Computers, video, graphics, audio and other sensory devices combine to create a new and exciting tool for the educator. One of the goals of the Art Humanities course at Columbia is to provide a foundation for visual literacy. We saw this course as an ideal candidate for this new multimedia tool because it would allow the following improvements over current presentation methods:

- immediate access to a greater quantity of visual material
- reduced preservation problems
- greater flexibility during a presentation
- provides an interactive learning environment

Our greatest obstacle was to provide the technology in a simple, easy to use fashion without restricting the educator's creativity. To overcome this problem the software has been designed specifically for the non-technical user.

Our presentation will discuss the successes and failures of the project, the results of the practical application in the classroom, the authoring language used, and what directions we are taking. Our live demonstration will invite the audience to author their own presentation as well as participate in our most recently developed presentation.

USING INTERACTIVE VIDEO TO DELIVER LECTURES AND TUTORIALS

Presented by: *Lynn D. Churchill* (206)543-0751 15945@UWAVM
University of Washington
Coauthor: *Clifford B. Gillman*
University of Washington

■

To present the potential uses of interactive videodisc in higher education. the large storage capacity and quick access capabilities of the videodisc medium has great promise for higher education. Uses in Art History, Neuropathology, Engineering and other fields will be presented. Specific aspects of interactive videodisc databases and tutorials will also be presented.

Major hurdles and considerations in the use and development of interactive videodisc instructional applications will be discussed. Considerations for configuration of both student and teacher workstations will also be addressed. The functionality and portability of applications is very hardware and software dependent. Some basic guidelines and cost/benefit factors for the applicability of interactive videodisc to instruction in higher education are to be presented.

Results of this work have produced a flexible editing and logging facility for authoring Interactive Videodisc applications. An interactive relational database access system for Art History has also been developed. These and other software developments for these applications will be available for preview at poster sessions.

THE USE OF INTERACTIVE VIDEODISK IN FOREIGN LANGUAGE LEARNING

Presented by: *Anthony J. Niesz* (203)436-1746
Yale University

The application of interactive videodisk technology to foreign language learning promises to have a great impact on the way in which foreign languages are taught in this country. The presentation will focus on the goals, methods, and pedagogical implications of implementing interactive video disk based learning in foreign language instruction. The technology of interactive videodisk will open up significant new possibilities in the presentation, practice, and perfection of foreign language skills among students, and will permit much greater emphasis on oral proficiency and situationally appropriate uses of language than was possible under more traditional approaches. I will outline the major hardware and software prerequisites, and the underlying principles which govern their application to foreign language learning. The presentation will demonstrate how technology can make significant contributions towards the student's achieving fluency in the target language. A sample demonstration lesson will be provided.

DESIGNING LEARNING MATERIALS FOR THE LANGUAGE LAB OF THE FUTURE

Presented by: *Janet Murray*
Massachusetts Institute of Technology

The Athena Language Learning Project, funded by the Annenberg/CPB Project for five years, is working to produce materials for a language lab which will be based on computer-driven workstations, combining interactive video, interactive audio, and the capability for artificial intelligence programs. Most of the resources of the project are devoted to the artificial intelligence system, which will allow developers to produce conversation-based exercises in the five languages taught at MIT: French, Spanish, Russian, German, and English as a second language. These exercises make use of simulation techniques to involve students in task-centered activities, and they are designed to reinforce communicative skills. This methodology sets them apart from the grammar-driven replacement drills of previous generations of computer exercises.

The interactive audio component of the project is working to develop a system which will give students feedback on intonation and pronunciation, using spectographic displays. It is expected that such digitally based audio systems will replace the present cassette-based technology.

Interactive video is particularly exciting as a teaching medium for foreign languages. The Athena project is producing a demonstration disc which will include several applications of videodisc, including the use of documentary materials, simulation exercises, and reading aids. These exercises are in French, Spanish, and German.

This presentation will offer a progress report on these exercises and an overview of the potential for language learning using these three computer-based technologies.

RT PC SYSTEMS ARCHITECTURE

Presented by: *William J. Spalter*
IBM ACIS

An overview of an architecture based upon a RISC engine and a high level machine interface.

THE INTERLEAF WORKSTATION PUBLISHING SYSTEM

Presented by: *TBA*

A look at the functional capabilities of the RT PC WPS by Interleaf. This presentation will give an explanation to the underlying architecture of WPS from a developer's perspective.

RECENT ADVANCES IN A.I.

Presented by: *Frank C. Tung*

A review of what is going on in IBM Research Labs and Scientific Centers in the area of Artificial Intelligence.

UNDERSTANDING AND USING THE GRAPHICS DEVELOPMENT TOOLKIT (VDI)

Presented by: *William G. Tuel, Jr.*
IBM Palo Alto Scientific Center

The Graphics Development Toolkit (VDI) is a device independent interface to the graphic hardware on the PC and on the RT/PC. The VDI shields the application from device variations by using dynamically loadable device drivers. This also makes it possible to route graphic output from display to hardcopy with no change in programming. A file interface is also available.

In this talk, the major VDI functions will be discussed and illustrated. The presentation will indicate which types of applications should consider using VDI, and which may be more suitable for a higher level interface, such as GKS or graPHIGS. The speaker will draw on his own experience with VDI.

ADDING DEVICE SUPPORT FOR ACADEMIC INFORMATION SYSTEMS

Presented by: *TBA*

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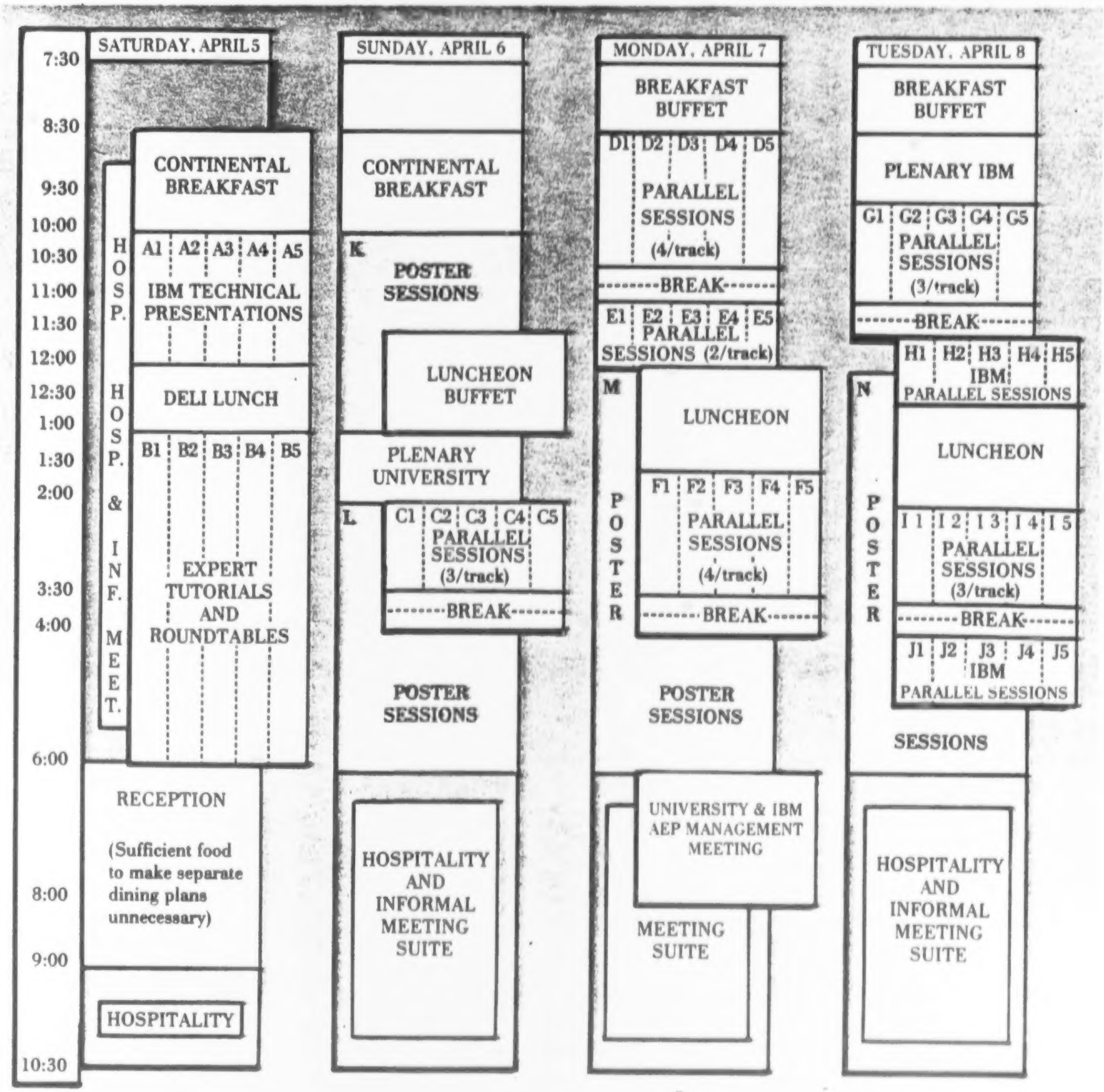
A step by step guide to developing and integrating device drivers for the Academic Information Systems 4.2.

CONFERENCE FORMAT
UNIVERSITY AEP CONFERENCE, SPRING 1986
TOOLS FOR LEARNING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SATURDAY, APRIL 5
HOSP.
HOSP. & INF. MEET.
CONTINENTAL BREAKFAST
A1 A2 A3 A4 A5
IBM TECHNICAL PRESENTATIONS
DELI LUNCH
B1 B2 B3 B4 B5
EXPERT TUTORIALS AND ROUNDTABLES
RECEPTION
(Sufficient food to make separate dining plans unnecessary)
HOSPITALITY
SUNDAY, APRIL 6
CONTINENTAL BREAKFAST
K
POSTER SESSIONS
LUNCHEON BUFFET
PLENARY UNIVERSITY
L
C1 C2 C3 C4 C5
PARALLEL SESSIONS (3/track)
BREAK
POSTER SESSIONS
HOSPITALITY AND INFORMAL MEETING SUITE
MONDAY, APRIL 7
BREAKFAST BUFFET
D1 D2 D3 D4 D5
PARALLEL SESSIONS (4/track)
BREAK
E1 E2 E3 E4 E5
PARALLEL SESSIONS (2/track)
M
LUNCHEON
F1 F2 F3 F4 F5
PARALLEL SESSIONS (4/track)
BREAK
POSTER
POSTER SESSIONS
UNIVERSITY & IBM AEP MANAGEMENT MEETING
MEETING SUITE
TUESDAY, APRIL 8
BREAKFAST BUFFET
PLENARY IBM
G1 G2 G3 G4 G5
PARALLEL SESSIONS (3/track)
BREAK
H1 H2 H3 H4 H5
IBM
PARALLEL SESSIONS
N
LUNCHEON
I 1 I 2 I 3 I 4 I 5
PARALLEL SESSIONS (3/track)
BREAK
J1 J2 J3 J4 J5
IBM
PARALLEL SESSIONS
POSTER
SESSIONS
HOSPITALITY AND INFORMAL MEETING SUITE

POSTER SESSION SCHEDULES

■

Poster sessions will be scheduled individually, by each university, within the hours indicated on the Conference Format page. A specific agenda of formal demonstrations will be provided in the information packet which you will receive upon arrival at the conference.

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